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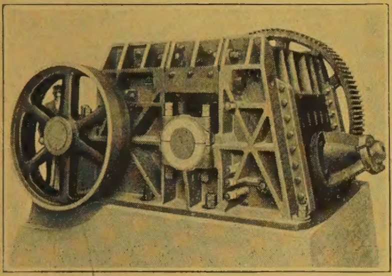

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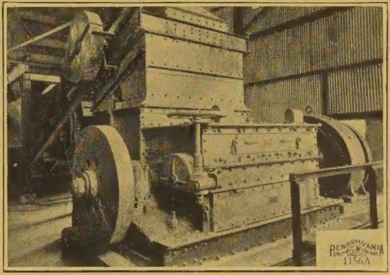

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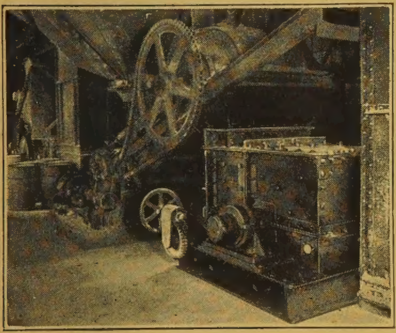

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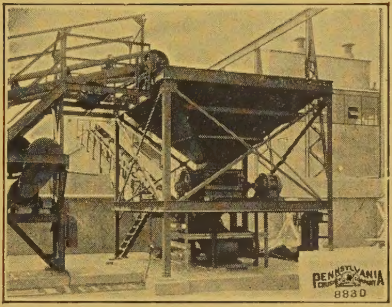

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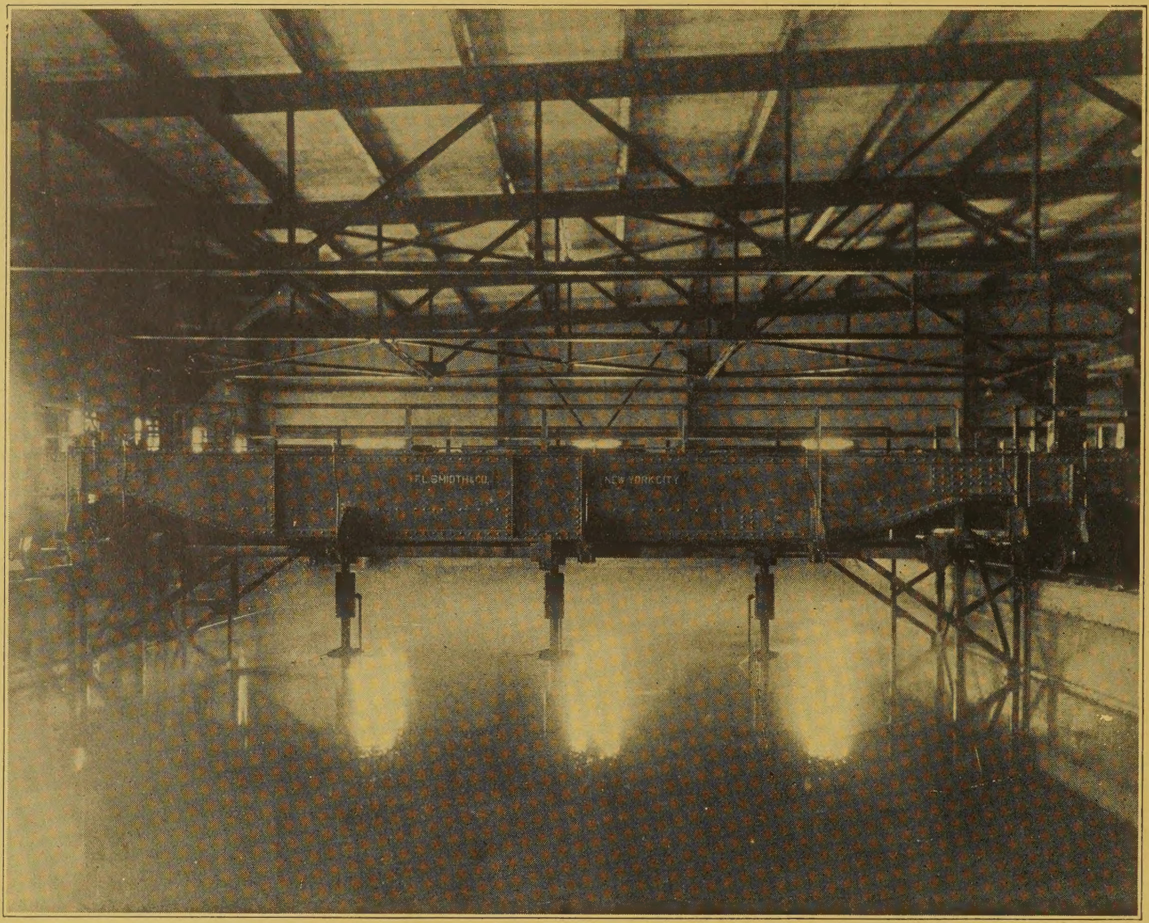

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The Cement Mill Edition of Concrete is edited exclusively for those interested in the manufacture of cement. Its pages are devoted to discussions of plant design, management, operation, production efficiency, chemical research and control, quarry operation, progress and news of the industry.

The Cement Mill Edition also contains all the material published in the corresponding Regular Edition and so provides news of the uses and merchandising of the materials whose manufacture is discussed in the Mill Edition. The Regular Section furnishes mill operating officials and mill executives valuable points of contact with the users of the materials they produce.

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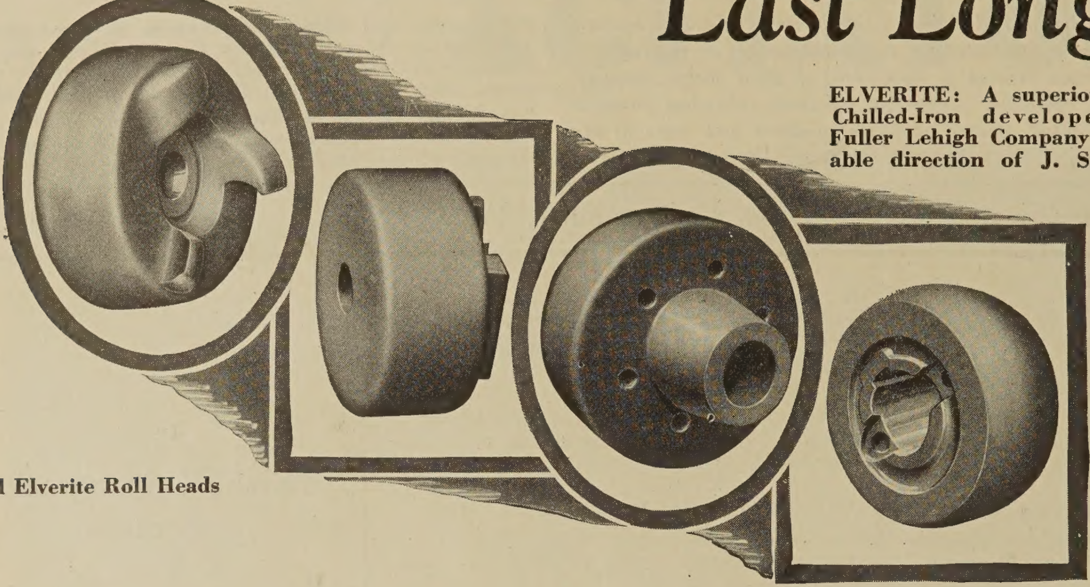

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MILL SECTION of

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Vol. 35 Chicago, November, 1929 No. 5

Can the Physical Testing of Portland Cement Be Improved?

The Cement *Shall*—

Test Provisions Must Be Rigidly Enforced to Secure Concordance Between Laboratories—Some of the Particulars in Which Testing Methods Fail to Agree

By R. R. COGHLAN

A FAIRLY comprehensive specification for the physical testing of portland cement has been evolved through the efforts of the American Society for Testing Materials which includes in its membership producers of the commodity, users and engineers who prescribe its use or have to do with its testing.

There has been a great deal of criticism of the methods of testing and the lack of concordance of results between various operators testing samples of the same lot of cement. It is true that the personal equation cannot be overlooked in the field of testing, but the writer feels strongly that if those in charge of testing were to familiarize themselves thoroughly with the specifications and absorb the idea that the word *shall* imposes obligatory conditions on the testing, a surprising amount of variation would quickly vanish and agreement result. It is felt that too many operators interpret *shall* as meaning that, if it is not too much effort or does not require an additional outlay for laboratory equipment or control apparatus, it will be done, otherwise *shall* means nothing and disputes arise which, though settled, leave a bad impression on both parties.

Variations Minimized

Portland cement from the same mill will show a surprising uniformity in all its characteristics if the yearly or monthly averages are considered. When daily averages are considered, slight variations creep in and these become more pronounced as the intervals between samplings become shorter. The producers are constantly on the alert to minimize the variations and wonderful progress has been made toward uniformity of the finished product. Improved methods of handling raw materials and preparing a regular feed for the kilns have come into vogue. Improvements in the burning of the raw material into clinker have been made. Flushing of raw material through the kilns has almost ceased to be a problem. Improved cooling of the clinker, eliminating the use of water, is coming to the fore, but is still a problem. Advances have been made in the grinding of the clinker into cement and the presence of coarse particles of clinker or grinding media in the finished cement is an operating accident.

The addition of the correct amount of retarder is still a source of trouble at some mills. Summing up we find that the last five or ten years have seen signal advances in the production of uniform cement. Recent changes in the strength specifications from 200 lbs. to 225 lbs. in 7 days and from 300 lbs. to 325 lbs. in 28 days, brought about a marked improvement in quality, as experience with foreign testing indicated that a wider margin would have to be maintained between mill tests and outside tests, if rejections were to be kept at a minimum or entirely eliminated.

> Methods of testing cement are scrutinized now more than ever before. Rigid enforcement of testing provisions is absolutely necessary if constructive progress is to be made in the matter of cement specification revision.
>
> The product of all cement manufacturers is tested in many laboratories. Unless rigid testing methods prevail, the manufacturer must maintain an unnecessarily large margin of safety in the quality of his product and the question of specification revision is practically dependent on the strict enforcement of testing methods.
>
> In this article, Mr. Coghlan makes some practical suggestions which, if followed, will go a long way to make for more uniform results in cement testing.

Some of the Shall's

In looking over the standard specifications for testing portland cement a number of *shalls* appear. Comment will be made on some of them.

Under sampling appears: "Samples shall be passed through a seive having 20 meshes per linear inch. In order to mix the sample thoroughly, break up lumps, and remove foreign materials." Failure to observe this injunction may easily result in lack of agreement in chemical analysis and the results of fineness tests. Under "fineness tests" the method is clearly defined, yet there are operators who seive with 25 or even 10 gram samples of cement instead of 50 grams; who, when they sift by hand, do not observe the correct routine.

Mechanical sifters must be carefully calibrated according to the type of machine. If a number of screens are nested, it is important to know the position of each screen and the proper correction factor to be employed. Under "mixing cement pastes and mortars" the amount of dry material is limited to not more than 1,000 grams nor less than 500 grams. Yet it is found that in making the test for normal consistency a number of operators use 300 grams of cement.

The determination of normal consistency is of the utmost importance as the effect of water-cement ratio on strength is now generally understood. Duplicate results should be obtained before proceeding further with the testing. The method of placing the paste in the Vicat ring is important and with many operators this is done in such manner that duplication of results is impossible.

Clean apparatus is of prime importance. The plunger should be free from rust or dirt and well oiled to permit of a smooth unimpeded movement. The setting time needle should be perpendicular to the base and not bent as is so frequently the case.

Soundness Tests

Under soundness—"The pat shall then be placed in an atmosphere of steam at a temperature between 98 deg. and 100 deg. C. upon a suitable support 1 inch above boiling water for 5 hours." Altitude affects the boiling point of water. It is therefore necessary to have a thermometer inserted in the steam bath to ascertain the correct temperature. If this is lower than prescribed, and due to altitude, the steam bath must be constructed so that it can operate under pressure, or the boiling point may be raised by proper addition of non-volatile chemicals. Pats boiled at atmospheric pressure at 5,000 feet and apparently sound, may fail when boiled at sea-level. There are well authenticated cases of this having occurred.

Under "tension tests" are found many *shalls*. The molds shall be wiped with an oily cloth. Where a great many briquettes are made in a day the one in charge of cleaning the molds finds his work lessened if the molds are well oiled. There is a difference between wiping a mold with an oily cloth and applying the oil with a brush. In the latter case, unless the mold is subsequently wiped with a clean cloth there is too much oil present on the mold. The method of making the test pieces is such that oil is sure to be worked into the mortar and will have a retarding effect on the hardening.

The mechanical manipulation of the mortar and placing in the molds is clearly defined, and if the letter of the specification is followed, uniform results ensue. The personal equation is most active at this point as the build and strength of the operator have their influence. A pressure of 15 to 20 lbs. quickly applied is different from the same pressure firmly applied. Further, a direct downward pressure is different from a slanting application. The breaking of the test pieces should be watched carefully.

Briquettes which break more than a reasonable distance from the smallest cross section are indicative of a fault in the machine—probably alignment of the clips. The distance between rollers should be carefully maintained and the free action of the rollers is most essential. Briquette machines should be mounted on a firm foundation free from all vibration.

The shortest clause in the specification, a clause which should be in capitals, is—"The air and water shall be maintained as nearly as practicable at a temperature of 21 deg. C. (70 deg. F.)." A permissible variation of 3 deg. C. (5 deg. F.) above or below 21 deg. C. (70 deg. F.) is allowable.

It is quite apparent that if the letter of the specification has been followed in the testing of cement there should be close agreement. There is no excuse for test pieces made by an individual showing a wide variation in values when properly tested, but there can be most startling variations between different laboratories due to temperature and humidity conditions. Cement is not like steel or brass, both of which are fixed in their properties, so that it makes no difference if they be tested as soon as cast and cooled or several months later. The strength values will be the same. Cement when tested for strength is undergoing continual chemical changes which, like all chemical changes, are influenced by temperature. Humidity also plays an important part in the early stages of the phenomenon known as setting and subsequently water in excess is necessary for the proper development of the phenomenon known as hardening.

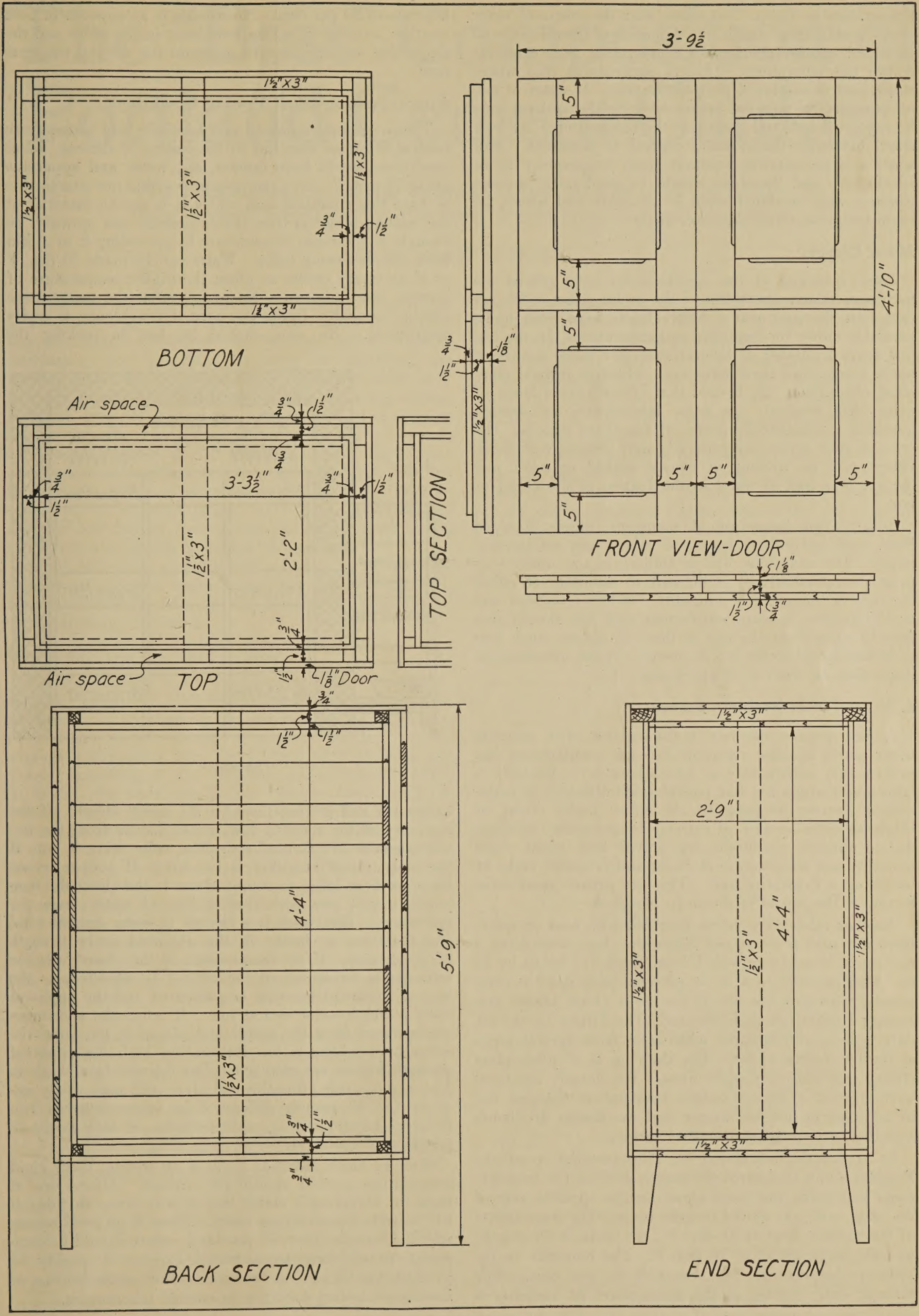
Maintaining Specified Temperatures

It is doubtful if there is any section of the country where the ideal temperature of 70 deg. F. exists the year round. In the summer, laboratories are too hot during the day and even at night. There is generally a short period in the spring and fall when laboratory temperatures are easily maintained and probably in most cases fall within the limits of temperature allowed. The water in briquette storage tanks, if standing, will always be found to be a few degrees cooler than the room where there is free circulation of air. In a well sealed room with little change of air the difference between air and water is less. If the water in the tanks is gradually flowing there is still a considerable difference between air and water even though the water enters the tanks at a higher temperature than that of the room.

A careful study should be made at each laboratory to determine the best means of controlling the temperature of briquette tanks. If the water supply comes from deep wells and is pumped to a standpipe of such capacity that it is filled and emptied several times a day, there will be little difference between the temperature of the water delivered in the laboratory mains and the temperature at which it leaves the well. This temperature will be fairly constant throughout the year. As in most cases its temperature will be below 70 deg. F., it can be heated by passing it through an enlarged section of pipe surrounded by a number of times of wire sufficient to raise the temperature of the water to 70 deg. or more when electric current is passed through the heater. The heated water should be delivered to each of the storage tanks through separate feed lines and not through one pipe to the upper tank and allowed to flow by gravity from one tank to the next.

If the temperature is practically 70 deg. F., it may be sufficient to submerge a single incandescent light bulb in each tank during the daytime, increasing to 2 or 9 at night if the temperature of the laboratory is apt to drop suddenly. In this case it is better to have the briquette tanks surrounded by an insulated frame making a separate compartment from the main room.

A wooden housing with intramural celotex makes a very satisfactory protection and can be kept at any desired



A moist closet constructed as described to overcome the objections mentioned temperature by lights. No matter what the source of water supply, all pipes within the laboratory should be well insulated against changes of temperature that originate within the laboratory. This is particularly true where steam heat is employed part of the year. If water of two temperatures is mingled before entering the tanks it may be regulated by hand control if the temperatures are constant, otherwise thermostatic control is indicated. Still water storage requires constant room temperature to be satisfactory and therefore should be used only in cases where a well insulated room is available and where the room temperature can be controlled.

Moist Closets

Later revisions of the specifications have placed the minimum relative humidity of the moist closet at 90 per cent. In the past many moist closets have been undependable either for humidity or temperature. In the last few years a number of laboratories have made studies of moist closets and there have been advances toward more ideal conditions. Be it said that closer concordance of values has resulted. In some laboratories the desired humidity is obtained by means of fog spray nozzles. The users of such sprays are generally well pleased with them. Others rely on wicking or canvas soaked in water and the use of a pan of water in the bottom of the closet or box.

Some of the boxes are of soapstone, others of wood lined with galvanized iron and others are refrigerator boxes. The soapstone box is subject to too much temperature variation and is difficult to maintain at either the right temperature or humidity. A heavy wooden box or refrigerator is more satisfactory and this should preferably open from the top as there is not so much loss of humid air when the box is opened for the introduction, inspection, or removal of specimens.

A Moist Closet Problem Solved

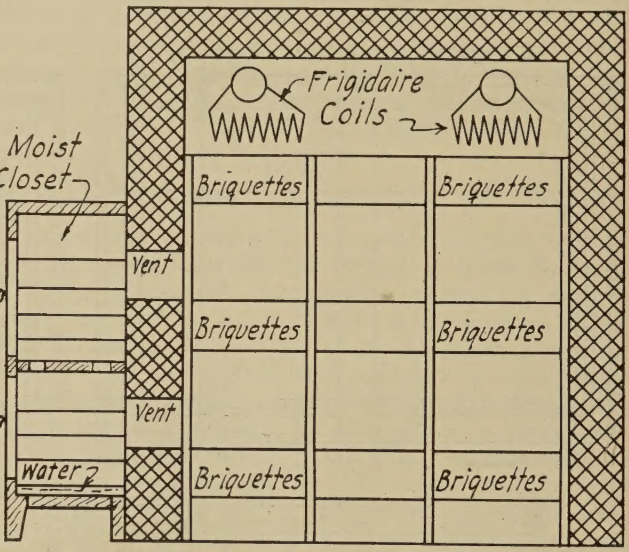
A cast porous concrete moist cabinet with running water and a shallow reservoir in each compartment has proven very satisfactory at one laboratory. Recently a laboratory, which has had considerable difficulty in maintaining correct temperatures in either moist closet or briquette tanks because of extreme temperature variations due to climatic conditions, has solved both moist closet humidity and temperature of closet and briquette tanks by installing a Frigidaire unit. This has proven most satisfactory. The layout is shown in Sketch A.

Another laboratory, never troubled with tank temperatures but with moist closet difficulties, has constructed a new moist closet lined with Filtros block 1½ by 12 by 12 in. This material with its 30 per cent pore space is completely saturating the air of the moist closet beside presenting a beautiful white interior. The Filtros blocks are only occasionally sprayed with water from special pipes at the top of the closet. The shelving is of plate glass sliding into place on angle irons. The heavily insulated walls protect it against sudden temperature changes, but in addition an electric heater and thermostat are being installed to keep the temperature correct.

In explanation of sketch A: after installation of the Frigidaire unit to control the temperature of the briquette room and tanks, the moist closet on the opposite side of the 12-in. wall was moved into the room. The temperature of the room is kept at 71 deg. F., the tanks at 70 deg. F. and the moist closet at 70 deg. F. The humidity in the room is between 85 per cent and 90 per cent, while through daily wetting of the moist closet its humidity is kept above 90 per cent. No trouble is anticipated in cold weather, as there is a small radiator in the room and the Frigidaire unit operates to maintain the desired temperature.

Approximating Ideal Testing Conditions

The writer has intimated that humidity and temperature control are most essential in the testing of cement. Ideal conditions would have cement, air, water and apparatus all at 70 deg. F. It is not always possible nor practicable to have this condition and really it is not so essential at the inauguration of the test. Cement can quickly be brought to the room temperature by spreading it in a thin layer on the testing table. Water can be made 70 deg. F or if necessary cooler to offset the higher temperature of cement, sand, and air. No matter what the temperature within reasonable limits the normal consistency is easily determined. No time should be lost in making the briquettes and getting them in the moist closet. If the humidity of the room is low, water distills from the test specimens to the atmosphere. The same thing is true if the moist closet humidity is too low. If proper means have not been taken to supply water to the closet the temperature will rise with further loss of water from the specimens. The result is a change in water cement ratio and therefore a change in the apparent early strength of the cement. If the temperature of the closet falls the setting and hardening of the cement is inhibited, as the heat of chemical reaction is dissipated and the apparent early strength value is too low. If when the specimens are removed from the molds and placed in the tanks the water temperature is too low or too high the apparent strength values are changed. Ten degrees from high to low is too much allowable variation and may easily account for 30 pounds difference in values between two different laboratories at early periods. It may result in rejection of a cement.



Sketch A

With so much attention focused on testing, more rigid temperature control should be stressed. Means are at hand for obtaining it and if testing is to mean anything it will have to become more exact. There is no good reason why the manufacturers of portland cement should be compelled to maintain at increased expense a quality of product that far exceeds the specification values because of inadequate testing facilities in outside laboratories.

The "Best" Composition of Portland Cement Clinker

An Examination of the Compositions of Certain Cements and Their Relation to Cement Performance in Concrete

By DR. ERNST JANECKE

NOW that the composition of the different constituents which make up portland cement clinker is more or less definitely established the question arises whether conclusions may be drawn regarding the quality of cement in its relation to composition. This is possible only if a certain quality corresponds to a certain composition. However, it is well known that cements of varying quality can be obtained from the same mix if treated in a different manner. Therefore, it will be assumed below that the clinker is manufactured in a manner producing the best results with a given mix, and these results will be compared for different mixes. It is familiar, that to insure the best results, special care should be given to the mixing, calcining and grinding processes.

In the following, one will find a discussion of the composition of German cements used to date, of their constituents and of the effect of variations in the composition on the quality of cement.

Composition of Portland Cement

The composition of portland cement clinker—considering the components CaO-SiO_2-Al_2O_3-Fe_2O_3—may be represented by a tetrahedron. In reviewing the composition of portland cement clinker, it appears notable that the average composition has varied but little through the years. According to Dr. Haegermann ("Zement," 1927, p. 1045), the variations in the average composition of cement clinker since 1910 have been slight. The silica content varies between 18 and 25 per cent with an average of 20.5 per cent. The average is thus slightly closer to the minimum than to the maximum value. The alumina content varies between 5 and 9 per cent with an average of 7 per cent; the iron oxide varies between 1 and 4.5 per cent with an average of 2.8 per cent. The average calcium oxide content is 64 per cent. Only the calcium oxide content shows some variation for in recent years the manufacture of high test portland cement has raised the average lime content by 0.83 per cent (85.51 to 64.28 per cent).

High test portland cement differs from the rest mainly by the release of the hardening energy in a briefer interval, so that great strength is already achieved at the age of 3 days. The total strength of high test portland is also higher than that of portland cement, but this is due mainly to more careful manufacture, particularly to finer grinding, rather than to difference in its composition.

Cement Composition Diagram

Since the composition of clinker has varied so little since 1910, the figure used here is that used by the author in 1911 in "Zeitschr. f. anorg. Chemie" (pp. 73, 200). The composition of clinker is represented by a rectangular, volumetric system of co-ordinates, whose origin is lime, the dimension to the right is silica, that extending upward iron oxide and forward alumina. This diagram is used throughout the following text.

In considering only the four constituents enumerated above, use cannot be made directly of a cement analysis, since the values in per cent of these constituents would not add up to 100. This should be kept in mind, for in adjusting the values to add up to 100 the percentages are increased. In returning to the analysis from values on the diagram, one should deduct about 5 per cent from all values of $CaO + SiO_2 + Al2O_3 + Fe_2O_3$. In constructing the portland cement clinker zone within the diagram the values used are not the absolute numerical values, but

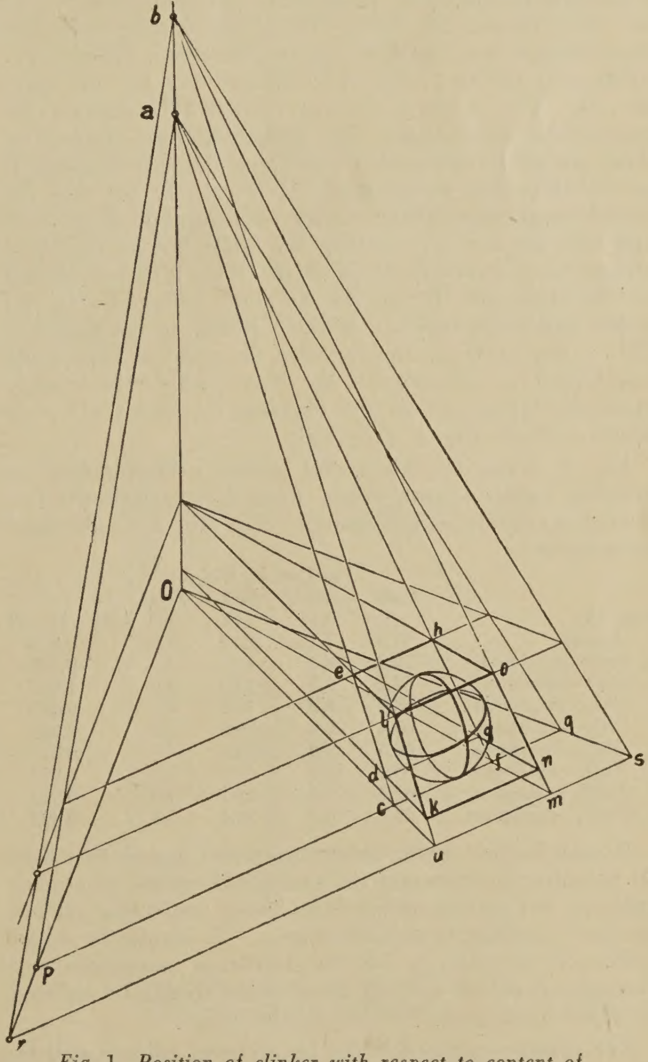


Fig. 1. Position of clinker with respect to content of CaO-SiO_2-Al_2O_3-Fe_2O_3

Translated from *Zement.*

beside Fe_2O_3 the ratios $SiO_2 : Al_2O_3$ and $(SiO_2 + Al_2O_3 + Fe_2O_3) : CaO$. The latter value is the familiar hydraulic modulus. The Fe_2O_3 content is assumed to be within the range of 1 to 5.5 per cent.

On the diagram these values are represented by two planes parallel to the horizontal. The clinker must be located between these planes. The quotient $SiO_2 : Al_2O_3$ for the values given above has a maximum value of 1 : 0.48 and a minimum of 1 : 0.16. The composition of portland cement clinker lies between these two values. A constant ratio $SiO_2 : Al_2O_3$ is indicated on the side SiO_2-Al_2O_3 by a certain point. All mixes having this constant ratio of SiO_2 to Al_2O_3 are represented by a plane containing the vertical line CaO-Fe_2O_3 and passing through this point on the line SiO_2-Al_2O_3. Fig. 1 shows both planes corresponding to the given ratio of SiO_2 to Al_2O_3. These are: the plane *Oub* for the ratio $SiO_2 : Al_2O_3 = 1 : 0.48$; and *Omb* for the ratio 1 : 0.16. Both ratios, when reduced to per cent, give 33 : 67 and 14 : 86. This narrow, wedge-shaped zone contains the portland cement clinker.

The Hydraulic Modulus

To limit further the zone of portland cement clinker the hydraulic modulus will now be considered. A fixed value of the hydraulic modulus is represented on the diagram by a fixed plane, which intersects all three co-ordinates at equal intervals. In constructing the diagram, a maximum value of 2.322 and a minimum of 1.79 were assumed for the hydraulic modulus. Reduced to per cent, these values are 30 : 70 and 36 : 64. The planes corresponding to these values were entered on the diagram. These are: plane *apq* for the ratio 30 : 70 and *brs* for the ratio 36 : 64. The portland cement clinker is contained between these two planes. The body *dknglohe* limited by these six planes contains all portland cement clinkers. It is not altogether rectangular. It is easy to see that the actual composition of the clinker varies around an average and it is not a nearly rectangular body, but an inscribed ellipse which contains all the mixes. This ellipse is drawn on the diagram. It touches the body *dknglohe* in six points and looks very much like a sphere in the diagram. This is due partly to the fact that the scale of iron oxide is enlarged to correspond to the others and partly depends upon the laying out of the diagram, in which all horizontal sections appear elliptical.

Fig. 2 shows the horizontal planes corresponding to different values of iron oxide. From it we obtain the following maximum and minimum values for the individual constituents:

		Per Cent by Weight			
	CaO	Al_2O_3	SiO_2	Fe_2O_3	$\frac{x}{31}+\frac{y}{35}+\frac{z}{59}$
Ref. No.		(x)	(y)	(z)	
1. Average	67.3	7.15	22.3	3.25	0.923
2. CaO—maximum	70.3	6.4	19.1	4.5	0.829
3. CaO—minimum	64.2	8.0	25.8	2.0	1.028
4. SiO_2—maximum	68.9	8.0	18.6	4.5	0.865
5. SiO_2—minimum	65.4	6.0	26.6	2.0	0.989
6. Al_2O_3—maximum	68.5	4.5	23.5	3.5	0.875
7. Al_2O_3—minimum	66.0	10.0	21.0	3.0	0.974
8. Fe_2O_3—maximum	67.3	7.6	24.1	1.0	0.951
9. Fe_2O_3—minimum	67.4	6.7	20.4	5.5	0.892

It must be said again concerning these figures that they do not directly represent the numerical values of clinker analysis, but are computed from these, neglecting all but the four constituents considered here. To obtain the actual values of the analysis for the minimum, maximum and average, all values read off the diagram should be reduced by about 5 per cent.

The values contained in the last vertical column will be discussed later.

Constituents of Portland Cement Clinker

It can be said today that the constituents of portland cement clinker are definitely determined. The constituent free from iron, which is designated by the term alite, is a mixed crystal of the compound $J = 8CaO . Al_2O_3 . 2SiO_2$ and $B = \beta\ 2CaO . SiO_2$. As mentioned elsewhere, both mixed crystals have a peculiar fusion diagram (Fig. 4).

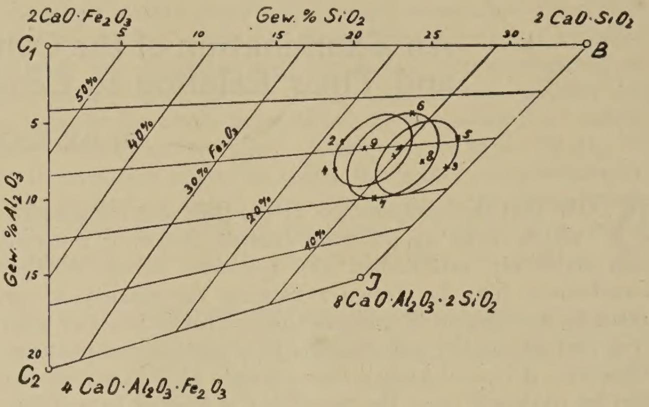


Fig. 2. Position and constituents of clinker, represented as a projection of the rectangular plat of the constituents CaO-SiO_2-Al_2O_3-Fe_2O_3

Neither of the two components *B* and *J* is fused directly. The β-dicalcium-silicate is formed through the congealing of the α-dicalcium silicate at a temperature of 1970 deg. C. The compound $8CaO . Al_2O_3 . 2SiO_2$, which has acquired the name of "Jäneckeit," also fuses indirectly. The congealing of a liquid melt of this composition at a temperature around 1960 deg. C. first brings about the formation of calcium oxide, which is followed by that of this compound. Therefore, while it is possible for these two compounds to form mixed crystals to any extent, it is also possible—due to the peculiar fusion diagrams—that the compounds form separately side by side. This is particularly true of β-dicalcium-silicate which is frequently encountered in the presence of mixed crystals. β-dicalcium-silicate is the so-called belite. Aside from these mixed crystals containing no iron oxide, the clinker also contains a number of mixed crystals with iron oxide, which represent the so-called celite of the clinker. According to investigations by Hansen, Brownmiller and Bogue ("Journ. Am. Chem. Soc." 50, 1928, p. 400), there are two compounds $2CaO . Fe_2O_3$ and $4CaO . Al_2O_3 . Fe_2O_3$ which form isomorphous crystals. The compound containing no alumina fuses indirectly at 1435 deg. C., the other directly at 1415 deg. C.

There are, therefore, two kinds of mixed crystals, the alite and celite, which make up the constituents of the clinker. In Fig. 3, similar to Fig. 1, are entered the weight ratios of the four constituents of clinker and the compounds just mentioned are indicated by points. *B* indicates the compound $2CaO . SiO_2$ (belite); *J*—the compound $8CaO . Al_2O_3 . 2SiO_2$ (Jäneckeit); C_1—the compound $2CaO . Fe_2O_3$ free from alumina and C_2 the alumina and iron oxide containing compound $4CaO . Al_2O_3 . Fe_2O_3$. By connecting these points one obtains a surface, which is not a plane, since producing the line *B-J* to the axis CaO-Al_2O_3 yields a different point of intersection from that of the line C_1-C_2 with this axis. This surface contains all possible mixtures of alite and celite formed in such a way that a certain mixture expresses an equilibrium of a certain iron oxide mixed crystal celite and of a certain iron free mixed crystal alite.

This is demonstrated on the diagram by drawing lines between points on the straight line *B-J* and C_1-C_2, the lines *B*-C_1 and *J*-C_2 being the limits. The fact that mixtures, whose composition is located along this surface, are built up from these two constituents alone was proven by microscopic studies of some mixtures. The entire field is to be investigated eventually. Such microscopic studies, however, are greatly hampered by the intensive coloring of the iron compounds. A thermal investigation of the high-iron mixtures should not be difficult, yet it is of lesser interest since it does not lie near the portland cement clinker. Considering only the mixtures with low iron content, and designating the contents in per cent of SiO_2 by x; Al_2O_3 by y and Fe_2O_3 by z, the following approximate formula of clinker composition is obtained: $(x : 35) + (y : 31) + (z : 39) = 1$. This formula gives the following per cent by weight of Ca $= (100 - x - y - z)$.

The formerly determined body, representing the composition of all German cements within the past twenty years, is also plotted in Fig. 3. As shown on the diagram, this body cuts the surface just discussed to a slight extent, and is generally displaced towards the lime origin. This can also be numerically obtained from the above formula by using the values in the table. Only one value of $(x : 35) + (y : 31) + (z : 39)$ for the minimum lime content yields—as shown in the table—a value greater than 1; all others are less than 1 and the average value is 0.93. This means that the portland cement clinker used in Germany in recent years had a composition which would bring the total of alite and celite to 93 per cent upon final completion of chemical processes. This will be again discussed below.

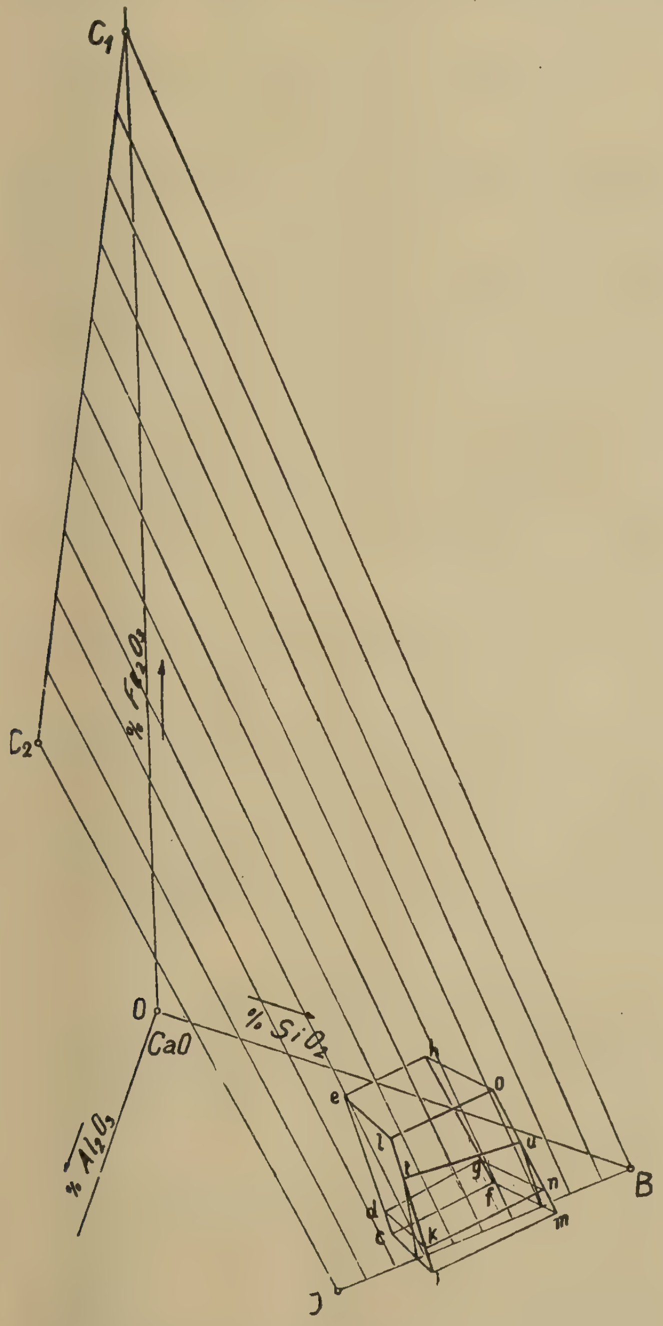


Fig. 3. Position of the clinker and of its constituents in a volume diagram of CaO-SiO_2-Al_2O_3-Fe_2O_3

Properties of Clinker in Their Relation to Its Composition

The relation of the properties of the clinker to its composition will be discussed assuming that each mix is treated in a way yielding the best clinker. Only general conclusions can be drawn awaiting further investigations. First, will be considered the properties of alite as mixed crystal and the effect on these of varying composition. Alite can be produced from a mixture of the compounds *B* and *J*. However, upon formation of alite, we no longer deal with a mixture, but with a mixed crystal of *B* and *J*. The properties of a simple mixture generally lie between those of the two constituents, from which it is made. This is not necessarily the case, however, for a mixture may be better in some respects than either one of the two constituents. The mixed crystals do not show a straight line relation connecting the properties of the constituents. It is frequently encountered that certain mixed crystals are endowed with better properties than the more favorably appearing constituent.

Fig. 4 shows diagrammatically the law of variation of the properties *B* and *J*, which form mixed crystals. The quality is plotted as ordinate and the curve shows that the best effect is achieved with a mixture which is nearer *J* than *B* and which is better than *J* alone. It is to be expected that the strength variation is similar for mixtures of *B* (belite) and *J* (Jäneckeit) and that the highest strength is found in mixtures containing more of the compound *J* than of *B*.

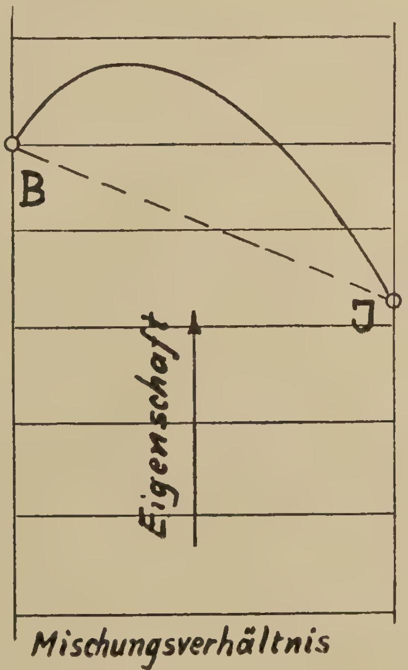


Fig. 4. Property of mixed crystals of two compounds B and J

The iron oxide compounds C_1 and C_2, which make up the celite, have hydraulic properties, which are, however, weaker than those of the iron-free compounds. The hydraulic properties of C_2 are stronger than those of C_1. The mixed crystals of C_1 and C_2 show a similarity to those of *B* and *J*. They are of but little interest.

The question is, what is the law of variation of the hydraulic properties of mixtures of mixed crystals of alite and celite. The properties to be investigated are those of mixtures, located along *B-J* and C_1-C_2 at certain points of intersection. It may be, that an admixture of an iron oxide compound to one free from iron improves the hydraulic properties of the latter. It is certain, however, that this favorable effect is slight and is apparent only with small admixtures. Thus, hydraulically better cement clinkers are to be found in the vicinity of the lines *B* and *J* with a low iron oxide content along the surface JBC_1C_2.

The actual determination, which would have to deal with a "chemically pure portland cement" is obviously difficult. It is the author's personal opinion that an admixture of a compound containing iron cannot greatly improve the properties, so that the effect of composition on quality becomes apparent in a gradual decrease of hydraulic properties along the lines from alite to celite. An admixture of iron oxide has, in the main, the desirable effect, that it reduces the temperature of fusion and brings about with greater facility the equilibrium of all—including the iron-free—compounds.

Effect of CaO

It remains to be seen what effect CaO, which according to the foregoing is always present in the clinker to the extent of a few per cent, has on the hydraulic properties. Is it possible that the admixture of a hydraulically weaker compound CaO to a more strongly hydraulic alite would improve the properties of the latter? The author would answer in the affirmative, and would maintain that an excess of lime would improve its properties. CaO is not generally considered to be a constituent of the portland cement clinker. However, as shown above, it must be present to a slight extent. Its quantity is assuredly small and amounts only to a few per cent, which is the reason why it is mostly neglected in the observations of clinker.

The author, therefore, believes that the most desirable mix is obtained with a low content of iron oxide and a slightly higher content of alumina than is generally the case in portland cement clinker. The constituents of the clinker might be expressed as follows:

$$\frac{x}{31}+\frac{y}{35}+\frac{z}{59}=0.95$$

where x, y and z are the percentages by weight of Al_2O_3, SiO_2 and Fe_2O_3, when these together with CaO are computed to give a total of 100. In using the analytical values the equation becomes:

$$\frac{x}{31}+\frac{y}{35}+\frac{z}{59}=0.9$$

and the percentage w of CaO would then be 95 minus x minus y minus z. Substituting for $z = 2$ per cent (Fe_2O_3) and $x = 8$ per cent (Al_2O_3), the equation gives $SiO_2 =$ 21.3 per cent and $CaO = 63.7$ per cent.

If these assumptions are correct, a clinker with 63.7 per cent CaO, 213 per cent SiO_2, 8.0 per cent Al_2O_3, 2.0 per cent Fe_2O_3 and 5.0 per cent other constituents would be the "best" clinker.

If the alumina content is increased to 10 per cent with Fe_2O_3 remaining equal to 2 per cent, the equation gives $SiO_2 = 19$ per cent and $CaO = 64$ per cent.

These values agree with practical experience. Whether they are actually correct is a problem requiring extensive investigation. It may be possible, however, to make use of the already available, extensive, statistical data. To this end the strength values should be represented with reference to the composition. Only the "best" values of a certain mix could be used. The data would be grouped according to iron oxide content for every ½ per cent and the strength values (at breaking load) plotted with SiO_2 and Al_2O_3 as abscissae and ordinates respectively. Equal strengths would be connected by curves, so that each diagram would show the mix of greatest strength for a given iron oxide content. It would appear that this would permit conclusions concerning the relation between composition and quality without taking recourse to "chemically pure clinker," i. e., a clinker made up of CaO, Al_2O_3, SiO_2 and Fe_2O_3 only. Any other property might be investigated by the same method. In all cases ten sheets are plotted, which, when superimposed, yield a volume diagram.

British Recommend Marking Order for Imported Cement

The Standing Committee appointed under the British Merchandise Marks Act has just announced a recommendation for issuing of Orders in Council for the marking of imported portland cement. It is recommended that the marking be done by stamping, printing, or affixing tags on the sack, bag, cask, or other container of the cement. This marking recommendation only applies to cement when for sale, and the committee does not suggest that cement should be marked on importation.

It was the view of the committee that while the large contractors did not need the protection of an order in the case of portland cement, smaller builders, whose purchases in the aggregate represented a considerable quantity, might not when buying be aware of the place of origin of the material purchased.

South Dakota State Plant Makes New Shipment Record

The South Dakota state cement plant at Rapid City, established a new record in shipments on September 24th when 35 carloads were disposed of to North Dakota, Nebraska, Minnesota, Wyoming and South Dakota, the majority going to the last.

The plant opened two months earlier than usual this year and it is expected that it will continue to operate some time beyond the customary closing period.

Alpha Earnings

Alpha Portland Cement Co. reports for 12 months ended June 30, 1929, net income of $2,375,368 after depreciation and federal taxes, equivalent after 7 per cent preferred dividend requirements, to $3.14 a share on 711,000 no-par shares of common stock.

Peerless May Install Own Waterworks

A possible saving is prompting the Peerless Egyptian Cement Company to look into the feasibility of installing its own waterworks at its plant on the St. Clair river, Port Huron, Mich. City water is now costing $600 to $700 a month.

Concrete Nov 1927 [illegible] pls.

EDITORIAL

A Broader View

DURING a recent conversation with an engineer who has done much work in the cement industry, the statement was made that the American cement industry is too self-centered—too prone to consider its problems as unique and incapable of being solved by the experiences of related industries.

That attitude, he said, coupled with the old-fashioned fallacy that processes must be kept "secret," which still persists in many plants, has hampered the technical and operating progress of the industry to a surprising extent in comparison with other industries.

This is harsh criticism, but an honest introspection must indicate that it is, in a measure at least, true. The fact that tremendous progress has been made in the merchandising and promotional field is due to the whole-hearted co-operation of the industry to secure that end. For years the cement industry has been held up as an example for other industries in that respect. But in the field of technical progress from the manufacturing point of view there is still much jealousy and a tendency to work independently so as to secure an individual advantage.

In this respect the cement industry can learn much from other manufacturers. Take the automobile industry, for instance. At a talk given just the other day before the Associated Business Papers at Chicago, Arthur Reeves pointed out some features of co-operation that may well be considered as an ideal toward which co-operative effort may be carried. In the automobile industry patents are pooled so that every manufacturer may put out a car that is a credit to the entire industry.

Officials of other automobile manufacturers, interested in some particular development that has been perfected in one plant, are invited to visit that plant and to have their engineers on hand with pencils and notebooks to observe and record methods and processes. Detailed descriptions of new developments are published in the business papers serving the industry. There is a feeling that the free interchange of ideas is ***absolutely necessary*** to the continued progress and well-being of the industry.

With all its progress, the cement industry still can learn much from others. In individual processes such as the reduction of raw materials or clinker to the most desirable fineness other industries have much to contribute. The use of powdered coal, kilns and furnaces, conveying methods, etc., etc., are not unique in the cement industry. It may be true that the particular application of these processes is unique, but the broad principles governing them are common at least to related problems.

Individual "secrets" and jealousies do not contribute to progress. A broader vision of co-operative effort is needed in the cement industry than merely the development of a larger market. Perhaps the lack of such a broader co-operative effort is one of the causes responsible for the present unrest within the industry itself. Today it is difficult for any industry to survive without co-operative effort. The need is to enlarge the scope of that effort—not necessarily in increased market promotion—but in adding to the co-operative efforts those other problems that do not come under the head of market extension. Such complete co-operative effort can supply real leadership. It will be able to cope effectively with those technical and operating problems that are now facing the industry and which are now being worked out independently.

Price Reductions

WHEN the price of a commodity is suddenly cut the first reaction is that it was done to increase the consumption of the product. This is only one of a number of reasons, most of which may be without foundation in actual experience.

It is not hard to determine from an examination of production, sales and price statistics that price changes have had little or no effect upon the total shipments of cement. Only fluctuations in the volume of construction influence shipments. A reduction in the cost of cement has little influence on the total cost of a structure and a price reduction cannot hope to noticeably change the volume of construction to be undertaken.

Cement manufacturers have a responsibility in this matter of maintaining a fair price. They have urged the fallacy of this practice before concrete products manufacturers and contractors. Is it too much to ask that they practice what they preach?

Price reductions based upon new operating and manufacturing economies are logical. But sudden drops made without corresponding savings in some department of the plant or office can only result in ultimate harm. They are apt to convey the erroneous impression that cement can profitably be sold at a lower figure.

First Unit of Arkansas Plant Opened

The new $2,250,000 plant of the Arkansas Portland Cement Company was formally opened on Wednesday, October 2nd, when the company was host to about 7,000 visitors.

The program for the day included an inspection of the cement packhouse during the morning, lunch for 250 guests on the roof of the packhouse at noon, blasting of limestone at the quarry, and later, inspection of the plant.

Charles Boettcher, president of the Arkansas Portland Cement Company, presided at the luncheon. Other company officials present were C. D. Nichols of Oklahoma City, vice-president; M. O. Matthews, manager of construction, and D. M. Pinkston of Little Rock, sales manager, and chief in charge of the day's ceremonies.

The unit dedicated is the first of three, the second now being under construction. Okay is situated 35 miles north of Texarkana.

First Chesapeake Bay Cement Barge Is Launched

The first all-steel self-unloading barge for transporting bulk cement in Chesapeake waters was launched on September 30th at the plant of the New York Shipbuilding Company at Camden, N. J. This barge was built for the Lone Star Cement Company Virginia, Incorporated, and is being used to transport bulk cement from the company's South Norfolk, Va., mill to its Washington, D. C., warehouse. Mrs. Dwight Morgan, wife of the vice-president and manager of the Lone Star Cement Company Virginia, Incorporated, christened the barge the "Lone Star No. 1."

The barge is 163 feet in length and has a beam of 37 ft. 4 in., with a total capacity of 5600 barrels of cement.

In explaining the purpose of the new barge, Morgan said:

"The launching of the barge 'Lone Star No. 1' at Camden today emphasizes several points which we believe are of real significance to this community. In the first place, this barge is part of the equipment which makes it possible for us to extend farther afield than would normally be the case, the market for a product made in Norfolk. As previously announced, the Lone Star Cement Company Virginia, Incorporated, is constructing special warehouse facilities in Washington, D. C. By providing the most economical means of transportation to this growing market we are establishing a necessary outlet for the product of Norfolk labor and hence an additional source of income which finds its way into Norfolk business enterprises.

"Another fact that should be emphasized is by making use of the low-cost transportation of the natural waterways of the country we are leaving no stone unturned in our effort to market our output against the invasion of foreign cement as far as it is humanly possible to do in the presence of such a glaring disparity between the low wages and transportation costs paid by foreign cement manufacturers and the prevailing American wage standards and transportation costs."

Indo-Chine Company Profits and Sales

The Societe des Ciments Portland Artificiels de l'Indo-Chine reports 7,520,000 francs ($1,504,000) profit for 1928. A dividend of 40 francs ($8) for each ordinary share and 472.20 francs ($94.44) for each founder's share has been declared. Sales in 1928 amounted to 166,615 tons, in 1927, 145,585 tons.

Burlap and Jute Exchange Opens for Trading in N. Y.

Announcement has been made that the newly organized New York Burlap and Jute Exchange, Inc., was opened for business on October 1st, at 80 Wall Street, New York City.

Manufacturers and others allied to the industries who use quantities of burlap, bags, jute, hemp and sisal are now able to check the world market price of these commodities, by reference to this single source.

The membership of the exchange includes a number of foreign shippers, as well as importers, brokers, traders throughout the United States.

With trading inaugurated, a manufacturer or user of any of these commodities who finds it desirable to cover his requirements or commitments for the following three or six months or perhaps longer, will be able to purchase options for such deliveries. When he has bought the actual burlap, bags, jute or hemp, he can resell his options on the exchange, so that in the intervening period he has protection on price.

In the same manner, a manufacturer who for some reason may find he has too much of the commodity on hand or purchased for future delivery, will be able to sell this surplus without the sacrifice usually attending such resales in a purely local market inasmuch as the new market will be worldwide in scope.

Standard grades and constructions have been fixed by the exchange, and integrity of contract assured by a clearing house.

The United States government has just given tacit recognition to exchange trading, by agreeing to make loans on cotton and grain which have been hedged.

Among the members of the board of governors are: W. R. Pinner, secretary and treasurer; Rutger Bleecker of the importing firm Rutger Bleecker & Co.; E. A. Canalizo, president of the New York Cocoa Exchange; F. R. Henderson, president of the Rubber Exchange of New York; Charles D. Orth of Hanson & Orth; Jerome Lewine, president of the National Raw Silk Exchange.

Kingsport Plant to Reopen First of Year

Full-time operations will be resumed January 1st at the Kingsport, Tenn., plant of the Penn-Dixie Cement Corporation, after being closed since early this year.

Plans for reconstruction work at the plant were considered at a conference of executives. Blaine S. Smith, president, in regard to the reopening said, "The end of the shut-down period at our plant is in sight. We are starting at once on the first stage of our construction project which will eventually convert the plant to wet process manufacture."

By January 1st new machinery will have been installed in half the plant, he disclosed, and work will begin with part old and part new machinery in use. A thirty-day shut-down will be necessary about May 1st, 1930, in order to connect the additional new machinery with that already in operation.

Panama Canal Orders Given Florida Portland

The Florida Portland Cement company, Tampa, Fla., has received orders for 20,000 barrels of cement to be used by the United States government in construction work at the Panama canal.

Italy's New Cement Plants Shun Antiquated Methods

Twelve Plants Constructed Since the War Up-to-Date—Outline of a Few Features of Each—Natural Cement Manufacture Continued

By **FEDERICO FEDERICI**

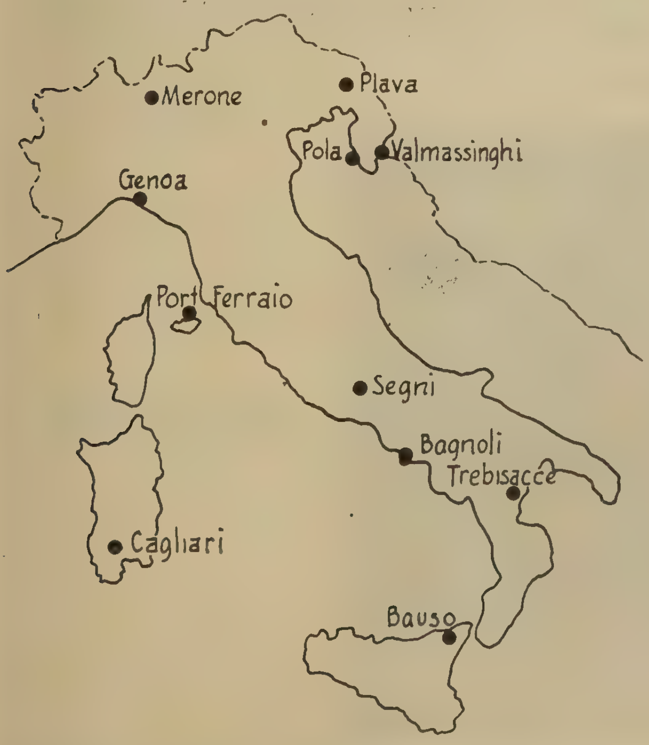
THAT natural cement is giving way to portland in Italian cement manufacturing is one of the important features of the country's present-day industry. Another is its slow transition from antiquated systems to modernized methods.

The demand even up to the present time for natural cement is credited to the low tensile and crushing strength standards of Italian specifications. A gradually diminishing manufacture of and demand for natural cement is predicted, however.

Of the most important plants constructed in Italy following the war, nine manufacture portland cement, whereas three produce the natural product. The chief plants, in geographical order, are located at Valmassinghi, Pola, Plava, Merone, Genoa, Porto Ferraio, Cagliari, Bagnoli, Segni, Bauso, and Trebisacce.

High Spots of Italian Plants

The plant at Valmassinghi, Istria, near Fiume, was erected in 1925 and 1926, in close proximity to an important deposit of cement rock of good chemical composition for both natural and portland cements. These deposits of marl are geologically the same age as those at Spalato, Dalmatia.



Map of Italy, showing location of some Italian cement plants

The plant is equipped with a rotary kiln and Unax cooler, compound mills in the raw department and a Pyrator dryer mill for coal.

The kiln and coal building at the plant of S. A. Cementi Portland Artificiali, near Genoa, Italy

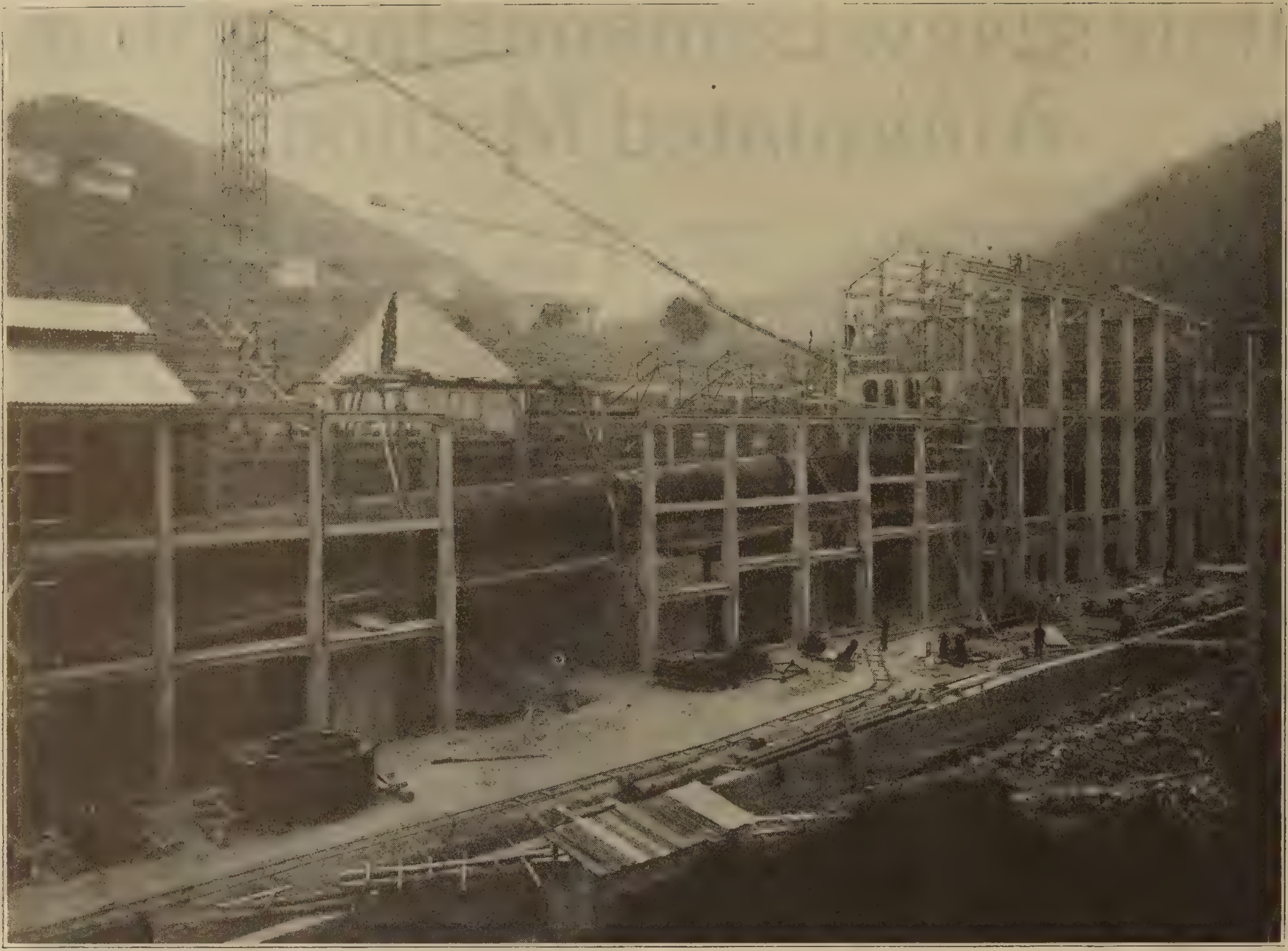
The Genoa plant, owned by the Italia S. A. Cementi Portland Artificiali, uses cement rock and limestone in the manufacture of artificial portland cement. Miag equipment is used. The quarry is located at Forte Ratti. Here rock is crushed by a hammer crusher and transported to the plant by aerial ropeway. Limestone is delivered in cars. After preliminary proportioning the raw material is conveyed to a three-chamber compound mill 12 by 2 meters (39 by 7½ ft.) driven by a 550 hp. motor, with reduction gear coupled to the mill. Eight reinforced concrete silos receive the ground raw material. The rotary kiln has a capacity of 1600 barrels a day. It is 60 by 3 meters (180 by 10 ft.) and is equipped with a 20 by 2 m. (64 by 6 ft.) cooler driven by a variable speed motor. The fuel employed—gas, coal, anthracite or coke—is ground after drying in a compound mill equipped with steel balls, flint pebbles and cylpebs.

Equipment

A traveling bridge crane conveys clinker to storage and then to the grinding mill, which is of the same type as the raw material mill. Both mills, located in the same room, are equipped to grind raw or finished material.

The finished product is transported to the concrete silos by a Fuller-Kinyon pump, where it is packed by the Silator method and Libra balances. Dust is collected by the Oski electric system.

The plant at Merone, near Lake Como, is one of the most recently erected. It has a capacity of 1700 barrels a day, is Polysius-equipped, and uses limestone and marl



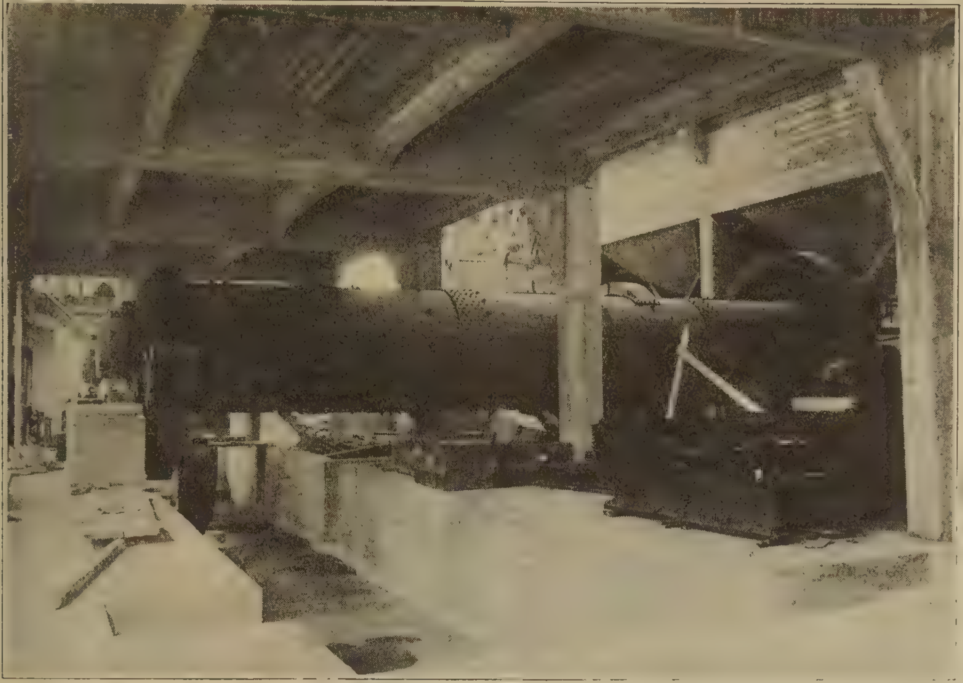
Showing the installation of the Miag rotary kiln at the Cementi Portland Artificiali plant

as raw materials. The quarries are situated 3 kilometers (2 mi.) from the plant. A cu. m. (3 cu. yd.) electric shovel loads the rock. The shovel is equipped with three motors, of 130, 65, and 64 hp.

Grinding Equipment

Grinding equipment is comprised of 5 compound mills —two for the raw material, two for clinker and one for reserve. The mills are 12 by 2.5 m. (39 by 8 ft.) driven

Balances for weighing raw material at the Genoa plant



The Miag compound cement mill at the Italia S. A. Cementi Portland Artificiali plant

by 400 hp. motors. Two rotary kilns, 58 by 2.7 m. (190 by 9 ft.) and having a clinkering zone of 3.6 m. (11.5 ft.) are used for burning. Each has a capacity of 900 barrels daily. Gas coal is employed as fuel. Inclination of the kilns is 5 deg. and they revolve from .56 to .79 of a turn per minute. Coal after being dried is ground in two tube mills and silos are provided for storage. The clinker silos have a capacity of 35,000 barrels. Automatic Bates machines are used for packing.

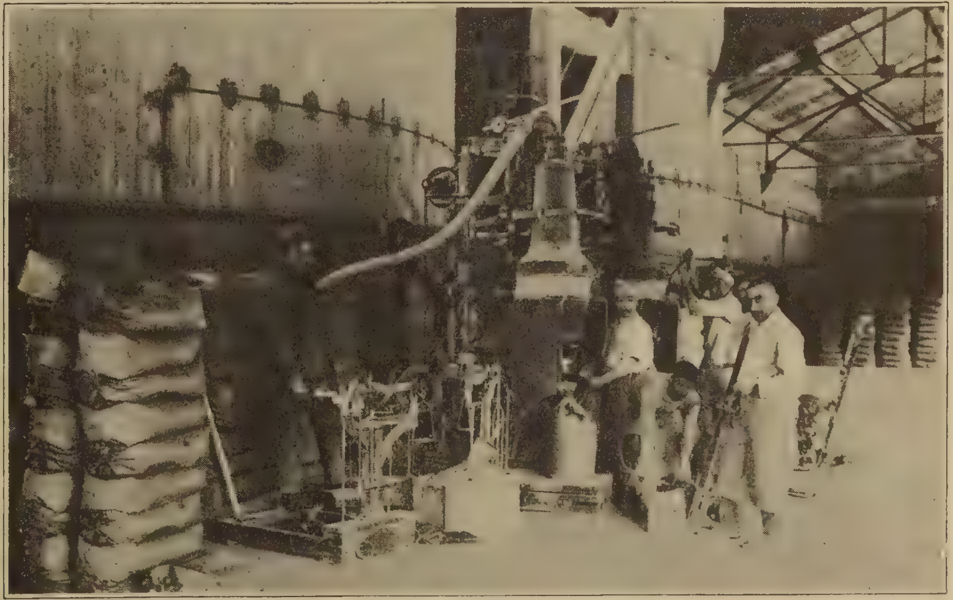
Ilva Company Plants

The two plants at Porto Ferraio, in the Elba Island, and at Bagnoli near Naples, are owned by and operated by Ilva, a large iron and steel company. Both use blast-furnace slag.

The furnace slag after being granulated and dried is mixed with limestone and burned in Fellner and Ziegler rotary kilns equipped with coolers and producing about 800 barrels of clinker per day. The kilns are 50 by 2.5 m. (160 by 8 ft.) while the coolers are 20 by 1.8 m. (64 by 6 ft.). Each plant is also equipped with three compound mills, for grinding raw materials, clinker and slag, and for pulverizing coal. The mills are driven by slow speed electric motors directly coupled.

Other Plants

The plant at Cagliari, Sardinia, was erected in 1920 and 1921 for the production of artificial portland cement by the wet process. A rotary kiln of 50 by 7.3 m. (160 by 9 ft.) equipped with compound mills, is installed at this



The Silator equipment in the packing house at the Genoa plant

plant. Miag equipment is used here also. Coal is ground by the "roulette" method. Lignite of good quality coming from the Bacu Abis is generally used as fuel.

The Segni plant, near Rome, produces artificial portland cement and is the sole Italian plant equipped to use potash.

Raw materials used are limestone, puzzolan, and silicious tuff. The first of these is transported by an aerial system from the quarry, which is 3 kilometers (2 mi.) distant; the others are found in the immediate vicinity of the plant. The Krupp rotary kiln, in which oil is used as fuel, is 60 by 2.5 m. (192 by 10 ft.). It is driven by a 36 hp. motor and produces about 900 barrels of clinker a day. The three Krupp compound mills are 9 by 1.8 m. (29 by 6 ft.) driven by a slow speed 360 hp., 180 rpm. motor. The production of one compound mill is 50 bbls. an hour of raw material and 40 bbls. of cement. The Cottrell system is used for dust collection.

A general view of the plant of the S. A. Cementi Portland Artificiali

The plant at Trebisacce, Taranto, was erected by the Societa Amonina Cemento Portland Dell' Adriatrico and in 1926 merged with the Italcementri.

The plant manufactures natural cement, utilizing the deposit of marl found in the vicinity. It is equipped with Mannstaedt vertical kilns and the usual clinker grinding compound mills.

Other plants in which improvements have been made are those at Calusco D'Adda, Albino, Oneglia and Civitavecchia, as well as Casale Monferrato, where new rotary kilns for the production of natural cement have been installed.

The plant at Pola, constructed in 1925 and 1926, produces aluminious cement by the Lafarge process, using Istrian bauxite and limestone. It also produces natural cement in Dietsch kilns, for which Dalmatian rock is used.

The plant at Bauso, near Messina, manufactures artificial portland cement, using a small rotary kiln, and is not of great importance.

The last of Italy's newest and most important cement plants is that at Plava, on the Isonzo river, constructed in 1921 for a production of 150 tons a day. Here natural cement is manufactured in four Dietsch kilns, each of four crucibles.

National Plant Scheduled for Vicksburg, Miss.

The National Portland Cement Company has made announcement of its plans to erect a $1,000,000 cement plant at Vicksburg, Miss. The entire site of the proposed plant is along waterfront.

The National company was recently organized, with the following officers: H. J. Harris, Dallas, Tex., president; Joe Finger, Houston, Tex., vice-president; C. T. Atkinson, Dallas, secretary-treasurer; C. W. Boone, Tyler, Tex., chairman of the executive board.

Two New Cement Mills Being Built in Czechoslovakia

A new cement mill is being constructed at Var, Slovakia, which will have an annual capacity of 3,000 carloads of cement. The new mill will be in operation early in September. Capital is being raised by the Banque Tcheque Union for the construction of another cement mill at Stupava.

Oklahoma State Cement Plant Is Proposed

A state-owned plant for furnishing state road cement was proposed by the Oklahoma Federation of Labor during its annual convention at Okmulgee, Okla., during September.

Pacific Portland Dividend

The Pacific Portland Cement Company on September 30th declared payable October 5th a regular quarterly dividend of $1.62½ on its 6½ per cent preferred stock.

Putting *Punch*
Into the Safety Campaign

Why It Is Everlastingly Necessary to Keep Pepped Up on Accident Prevention

By JACK DEMPSTER
Canada Cement Company, Ltd., Port Colborne, Ontario, Canada

IT is a great honor for me to have the opportunity to say a few words on behalf of the greatest of all activities, and a pleasure, for I am in a position that is perhaps different from that of the majority of my listeners. I am not an official in our industry, therefore I have a somewhat better chance to judge of the reception of certain lines of procedure by those of the rank and file and, in addition, for some seven years I have been the editor of an employees' publication which has been a sort of intermediary between management and men. An added incentive for me to be somewhat active in safety work is the fact that I suffered an avoidable industrial accident.

Early in this summer, as we all know, the facilities of the National Broadcasting Company were extended to the National Safety Council, in order to present a series of safety talks over the radio, and stimulate an interest in accident-prevention in the peoples of all classes on our continent, and it was estimated that an average audience of thirty million listeners heard each address. This series met with a wonderful reception, to judge by the number of commendatory letters and requests for copies of the talks received by the council. Now why did the council use this method and why was the response so great? Could not these talks have been printed in our newspapers or distributed as circulars and the same results obtained? No! Radio is still a comparatively new thing, and we still get a certain amount of thrill from hearing addresses by the captains of industry and the leaders of our country, especially when we can listen in the ease and comfort of our own arm chair at home. In other words, there was a "punch" in that Safety Series, and because of that "punch" many portions of the addresses will be remembered, whereas, had they been skimmed over in the evening newspaper, ten chances to one they would have been totally forgotten by the next morning.

What Is "Punch?"

Getting "punch" into a safety campaign! What is this "punch"? The word, as it is used here, is not found in the dictionaries and the only alternate word we can use for it is "pep." It is a sort of enthusiasm with a "kick" in it, isn't it, or sincerity carried to the highest degree. For goodness' sake, can you imagine that any campaign is going to be successful if it is conducted in a half-hearted manner without any thrills whatever, much less a safety campaign, which is to a great extent a psychological reaction? I'm going to say right now, and I know, that a luke-warm safety attitude does more harm to the cause than if a special endeavor was not made at all, for once let men get the impression "Oh, the boss feels that this is something he has got to go through, and he doesn't expect a whale of a lot from it," and—"Say! for goodness' sake, leave the men alone and they'll help themselves a whole lot better." In his game a cynic is the most dangerous man on the plant, whether he be an official or an unskilled laborer, yet I know of some officials who came out with the statement that accident prevention was just as important a part of their business as production of cement, and—they act as if it were, too.

Why are we attending this meeting of the Cement Section—this Congress? Did we come here to sit comfortably, hear a few talks, listen to some accident figures and remark "too bad"; then see the sights of Chicago and go home, feeling that we have helped the safety movement? If that's right, we'd have helped it a whole lot more by staying home. *Remember this!* We have been chosen to attend these meetings as representatives in an *endeavor*—not to have a good time. Sometimes I wonder whether we are all safety workers, or whether we are putting up a certain amount of bluff, for we all know that accident reduction in the cement industry is not satisfactory.

Yes, I know that some of you are saying that our figures are showing a great reduction; but, I ask you, a reduction from what? Say we had one thousand accidents last year and seven hundred and fifty this year, has accident prevention improved twenty-five per cent. How do you know that a large percentage of that reduction was not due to the fact that a different class of men was involved, or due to improved operating conditions to increase production? I want to say this, that as long as we can read in the records of the Portland Cement Association, month after month and year after year, without a break in the continuity, accounts of screw conveyor accidents and fatalities from other causes, we have nothing to be proud of, but rather does it constitute a disgrace—a disgrace to the cement industry and a disgrace to the civilization of North America.

Putting a "punch" in safety work! My God! Isn't the account of one screw conveyor accident "punch" enough so that there will never be another one, and yet there was a fatality from this cause in June! June, and on the last day of May we stuck our little chests out and said that we weren't going to have any accidents in June at all. That screw conveyor! In nearly every accident report of the association we read of one or more cases in which that screw conveyor is involved, don't we? and it strikes me that that screw conveyor furnishes a darned good alibi for carelessness! Somebody said that the screw conveyor is a diabolic piece of fiendish ingenuity. It is not! It is a whole lot safer than pulverized coal which is being blown by a current of air into a kiln. Yes, that screw conveyor is an alibi for a good many faults, and how we can allow it to go on grinding living flesh and bones, as well as convey other material, year after year, and then kid ourselves that we are eliminating accidents, is beyond me. Why, our screw conveyors are more efficient when they are covered by a grating that will keep out foreign material! We all know that and yet we deliberately allow men to uncover them, leave them uncovered while operating and think we are showing mercy to such men by merely reprimanding them. More bluff! A child goes to school to learn a lesson!

Reducing Fatalities

"Punch!" We need a punch all right, and here it is! If we need any more punch than the statement I am going to make, we had better quit calling ourselves safety workers. Do you know that, while we have been patting ourselves on our little backs and receiving plaudits from everyone, from President Hoover down to Mutt and Jeff, because of the reduction in the total number of all accidents, that the number of *fatal* accidents has been steadily and insiduously on the increase? Do you realize that fatalities in the cement industry have increased, INCREASED, *INCREASED,* until their total is 52 per cent greater for eight months of 1929 than for the same period of 1928, *and where's it going to stop?* We are the ones who are responsible for the deaths of those men! We are the ones who will be responsible for every fatality that adds to this year's total, and we are the ones who should, if we have any manhood at all, have no rest as long as we allow these fatalities to remain as a dirty blot on the pages of our record.

Don't you see, gentlemen, that our batteries are run down? We need recharging. Isn't it a terrible thing to contemplate that on Saturday, August 10th of this year, in our cement industry, there were five men killed! That is a fact, and a very deplorable fact; and isn't it a real punch, right in the solar plexus? Just in case you would forget those five fatalities, let me add that because of them five women were left without a husband and breadwinner, and fifteen childen—think of it—fifteen children were left fatherless. Do you realize what a widowed mother of three or more children has to buck against to get along in the world today, and do you realize the handicap that is forced upon those children, who were brought into a merciless, competitive world without their own volition, and then left fatherless? That is a good sized start for an orphan asylum from our cement industry in one day. What a terrible thing a fatal accident is! Just suppose YOU were the next to be stricken down. Can you see what it would mean? And yet, because of the luke-warm, half-hearted attitude that some of us are taking in this work, it strikes me that none of us are immune.

Now, gentlemen, let us be frank and reason this thing out. Let us admit that we are paying too much attention to the avoidance of those which we call "fatal" accidents, and not enough attention to "accidents." One of the cement officials said to me one day, "We are doing very well; we haven't had a *fatal* accident in our whole company so far this year." Just what is a "fatal" accident, anyhow? An accident that causes death, isn't it! And what is a potential fatal accident? One that could or might have caused death! Now then, there is absolutely no difference between a potential fatal accident and a fatal accident, as far as accident prevention work is concerned, is there? The only difference that there is at all is in the final result from an accident. Well, where are you going to draw the line between an *accident* and a *potential fatal* accident? Three men on our plant received broken legs, at different times. One recovered fully; one had his leg amputated at the hip, and the third died. How many or which of these were potential fatal accidents in the first place? Possibly the primary condition of the man who died was better than that of the other two. Three men had their hand caught in machinery. One man shows only a scar; one has lost his thumb and the third man died. Where would you draw the line there? A man working for our company was talking to some other men; he turned around and somehow injured his knee-cap. He was taken to a hospital and died. One of our foremen received a small abrasion on his neck, very small, hardly bigger than a mosquito bite. He was laid up for months and very nearly lost his life.

Every accident is a potential fatal accident, and is as much of a blot on our record!

We are too complacent; we are not getting punch into our work at all. We are trying to shift the responsibility, evade the issue and then deplore the facts. For goodness' sake, if saving human lives won't afford a "kick," surely saving money will and we can dig up stacks of records proving that safety work saves money and speeds up production. The kick that we get out of it will be in proportion to the punch that we put in, and in these days of the Eighteenth Amendment and the Ontario Liquor Control Act you can understand that the "kick" is what makes it work.

A Kansas boy went away from home while quite young and stayed away for a number of years, during which he made a name for himself and, of course, lots of money. They always do in the story. In a sentimental mood one day, he decided that he would return to his old home for a visit, which he did and was given a great reception. Later on, the old minister told him that they intended holding an old-time church social on the following evening and extended a hearty invitation. Our friend accepted and his thoughts went back to his boyhood days and the other socials he had gone to. He remembered how the men sat on seats arranged along one side of the hall and the women along the other side. Invariably the men talked big-time and small-time politics, and over across the room one could hear the women talking about putting up preserves. He went, and things hadn't changed, at least not much. The men were still seated along one side of the hall and the women along the other side but, as he walked up the middle of the floor and overheard snatches of their conversation, he got a surprise. The women were talking about voting to put the mayor out and from the men's side—"And say, fellows, you must boil it for three hours and don't forget to put the yeast in."

Interest Must Not Lag

If we are sold on accident prevention work and thoroughly sincere in our efforts, how do we go about maintaining the interest of the men in the ranks? Don't forget, yours is the responsibility for their success or failure and it all depends upon how much they are convinced by you. Recurring campaigns must not be treated as a continuation of other campaigns that were failures. They must be treated as entirely new activities and the method used at the onset will be the one that makes the deepest impression.

A large tobacco company of Canada has adopted the policy of having a man in their employ meet all the emigrant-carrying steamers that dock at Montreal, Quebec and Halifax. Each foreign arrival to our country is quickly interviewed by this tobacco-man and presented with a large package of a well-known brand of tobacco. What are the impressions of that emigrant? He is unversed in the manners and customs of the new country he has come to and he doesn't even know what kind of tobacco to buy, but I'll wager that as long as he lives he will remember that the first tobacco he ever smoked in Canada was that brand given him—and you all know what human nature is. The cost of that tobacco to the manufacturer could well be charged to very profitable advertising. That is why I say I believe that every safety campaign should be launched as an entirely new undertaking, without any reference to previous campaigns, as far as the method of working is concerned, but only for the purpose of comparing results. First impressions are the ones that linger and if at the beginning of each new drive the men *are* impressed, they are half won over.

I have always believed and always will believe, that the greatest factor in this work is that of education. I have seen, as doubtless many of you have, men deliberately remove mechanical guards and not replace them, and men have been hurt under conditions that you would have sworn were mechanically safe. I heard one of the biggest men of this country say that industry was not going to have success in its accident prevention work until all management realized that personal safety is something that must be included in a curriculum, starting with the school children and included in every branch of industry throughout the land.

Now, gentlemen, in closing, let us get serious. Are we honest-to-God sincere as safety workers? Any man who is devoting his time to accident prevention work has a foreman that is worthy of his steel. It is something that keeps him awake at nights and possibly contributes a few gray hairs, and a crease or two on his brow but, oh, man, think of the reward that comes with the knowledge that you are doing your best to save human beings from being killed, that you are helping to conserve the wealth of the nation, AND THAT'S JUST WHERE WE ARE LIABLE TO PUT A CRIMP IN THE WHOLE BUSINESS if we dwell too long on that fact! We are *not* doing something for which we deserve the thanks of the industry or the community; we are only doing our duty, and we are *not* doing our duty if we are not safety workers. Does a father expect recognition and thanks when he educates his little child against dangers? This work is never going to be finished; we are going to receive set-backs and discouragements, but the spirit that has placed portland cement in the position it occupies in the world today is the spirit that will reduce the accidents from the portland cement industry to practically a vanishing point.

Conclusion

This can be done but it depends on you. You are the ones who have made the name portland cement a synonym for quality and honesty in efficient production. You are the ones who have given of the best that was in you to build the new world and you are the ones who must keep the irreproachable status of portland cement from being tarnished by the frequency of the accidents suffered in its production. See that we are thoroughly sincere in this matter and for God's sake don't come out with a splash today and then forget the enthusiasm next week. *That's* where safety work is criticized most by the rank and file. They are not sold to a great extent by your arm-waving and exhortations of today alone, but they are watching—watching to see whether you are going to be working for their safety next month and next year. Surely it's a big job and it takes real men to handle it, but cement men can do it. The success of all accident prevention work as viewed by one in the ranks, rests upon one man. The punch, kick, enthusiasm, thrill, call it what you may, is only serious, cool, level realization that, whether you be manager or oiler, superintendent or burner, the only man that can make and keep you safe is you, and you are your brother's keeper!

To put a "punch" in Safety? Can you ask a man today
To dwell upon these horrors; to view without dismay
The loss of human beings' hands, their feet, their limbs, their lives—
The misery and sorrow of their children and their wives;
Homes that were once so happy, echoing now to women's tears;
The future all uncertain, the vision naught but fears—
Can you read without a heart-throb of the graves, now filled with men
Who should, and could, have been alive today, now gone; and then
Is safety work a new-fledg'd thing, just sired by management,
A set of arbitrary rules, or is it really meant
To be humanitarian, a spark of thought a choice
That bids us pause? Ay! 'Tis just that! Then let us raise our voice
To guard and curb the reckless acts that grind the flesh and blood
Of our best manhood. Wipe that stain, and staunch that bleeding flood;
Those tears of wives and childen; but, this thing is surely true—
The only one can put a "punch" in safety work, is you!

Lehigh Reports $5 Dividend on Common Shares

Lehigh Portland Cement Co. reports for year ended August 31, 1929, net profit of $3,676,051 after depreciation, federal taxes, etc. After deduction of preferred dividends paid, balance was $2,167,854, equal to $4.81 a share (par $50) on 450,348 shares of common stock. This compares with net profit of $3,814,393 or $5.07 a share on the common in preceding year.

International 1929 Dividend is Higher

The International Cement Corporation quarterly report, issued during October, shows a net to surplus in the third quarter of $1,360,356.17 as compared with $1,149,788.82 for the second quarter, and $1,017,619.59 for the first quarter, a total for the nine months of $3,527,764.58.

The earnings, after allowing for interest on gold debentures, are equivalent to $5.70 per share on 619,049 shares of common stock outstanding on September 30th, as compared with $5.43 per share on 618,826 shares a year earlier.

Oregon Portland Dedicates Its Safety Trophy

The Oregon Portland Cement Company held dedicatory exercises, in celebration of its receiving the Portland Cement Association safety trophy for 1928, at the plant at Oswego, Oregon, on September 19th.

Following opening remarks by Vice-President L. C. Newlands, A. J. R. Curtis of the association presented the trophy to the plant. D. H. Leche, general superintendent, spoke words of acceptance in behalf of the plant. The address of the day was by Senator Joseph E. Dunne.

North American Purchases Cement Rock Reserve

Purchase of 153 acres of land containing large quantities of cement rock has just been made by the North American Cement corporation near its plant at Alsen, in the town of Catskill, New York. Negotiations for all but a small portion of the area have been concluded, and deeds passed, it was said.

The company is also reported to hold options on 200 acres additional in the same vicinity, which may be taken up during the next five months.

Illinois and Iowa Show Greatest Increases in Cement Production

Cement production in the states of Illinois and Iowa is increasing more rapidly than in the country as a whole, newly released statistics show. In 1928 the combined output of these two states amounted to 23,026,000 barrels, compared with 18,541,000 barrels in 1927, a gain of 24 per cent. Production of all other states combined increased only 2 per cent.

Output of Illinois mills increased from 14,833,000 barrels in 1927 to 17,677,000 barrels in 1928, a gain of 20 per cent, while that of Iowa increased in the same period from 3,708,000 barrels to 5,349,000 barrels, a gain of 44 per cent.

Penn-Dixie and Hawkeye Given State Road Contracts

The Pennsylvania-Dixie Cement Corporation and the Hawkeye Portland Cement Company, both at Des Moines, have been awarded contracts for delivery of cement to paving contractors by the state of Iowa.

The commission, according to its chairman, bought the cement direct in order to save the dealer differential.

New British Colliery to Erect Cement Plant

Negotiations have been in progress for some time between the Tilmanstone Colliery, the newest British coalfield, located in Kent, England, and the Dover Harbor Board in connection with a site for the proposed cement plant to be erected by the colliery company. An extensive area has been decided on at the Dover Dockyard, at the extreme east of Dover Bay, where also are located the discharging bunkers of the aerial ropeway from the colliery.

Chalk, clay and coal resources are all under the control of this colliery, and they are accessible and in close proximity to each other. The two most important deposits of chalk in the world are those located on the south coast of England and the opposite coast of France, and the former will serve as a source of lime for the new plant.

The best clay for cement—galt clay—is found in close association with the chalk deposits on the English south coast. It is claimed that Kent coal is very suitable for cement making because of its high calorific value and the ease and cheapness with which it can be pulverized.

The erection of this large cement plant will undoubtedly have a beneficial effect on the present condition of Dover, which, since the war, has been passing through an extremely difficult period, though local labor conditions, according to the official unemployment figures, have been gradually improving. The cement works is one link in a chain of industries which the colliery intends to establish.

Wolverine Portland Dedicates Safety Trophy

The Wolverine Portland Cement Company, Coldwater, Mich., formally dedicated its 1928 Portland Cement Association safety trophy on October 10th, with an appropriate program.

L. A. Hutchins, chairman, presented the Portland Cement Association representative and Superintendent John Dieterman, in behalf of the employes of the plant, in turn accepted the trophy.

A first aid team of six men under the leadership of Claud Paul gave a first aid demonstration. Glenn Caldwell gave the principal address of the afternoon.

Wolverine Makes Improvements; Buys New Kiln

The Wolverine Portland Cement Company of Coldwater, Michigan, recently purchased from Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin, a 10 ft. diameter rotary kiln 300 ft. long.

This kiln is designed with five supporting tires, and the carrying mechanisms are of the two roller type, oil lubricated. The purchase of this kiln is in line with the plans of the Wolverine company to make extensive improvements at their Coldwater properties. It is expected that this kiln will be shipped in December of this year, and under the direction of L. L. Stone, consulting engineer of Detroit, the kiln will be ready for operation in the early part of 1930.

Shippers Report More Cement Transported; Less Produced and Stocked in 1929

Shipments of portland cement in the Atlantic states increased slightly during the present year, while production and stocks on hand have decreased. In the United States, shipments and production have decreased and stocks have increased, according to a report made before the twenty-fifth regular meeting of the Atlantic States Shippers Advisory Board, held at Utica, New York, October 3rd.

Square yards of concrete roads, streets and alleys contracted for have decreased both in the Atlantic States and in the United States during the period January 1st to August 31st.

The same is also true of contracts awarded for classes of building and construction work, including roads, streets, bridges, sewers, etc., January 1st to July 31st.

While the value of building permits January 1st to July 31st in 41 principal cities in the Atlantic States shows an increase over 1928, a decrease is shown in the United States as a whole.

It is estimated that shipments for the fourth quarter of the present year will not exceed 1928 by more than 5 per cent, when 62,320 cars were shipped.

Railroad service has been generally satisfactory, but there has been no improvement in the complete unloading of cars furnished to the cement industry for loading.

A detailed statement follows:

(Figures shown in thousands of bbls.)

	Atlantic States		United States	
	1928	1929	1928	1929
Production, Jan. 1st to Aug. 31st	33,124	32,474	113,294	110,840
Shipments Jan. 1st to Aug. 31st	32.829	32,983	115.824	113,556
Stocks on hand Aug. 31st	6,947	6,214	20,101	24,525

Studies on Fundamental Synthesis of Calcium Aluminates and Their Hydration

By **SHOICHIRO NAGAI** and **RYUICHI NAITO**

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IN the studies (O. Schott, E. S. Shepherd, A. Rankin and E. Wright, W. Dyckerhoff, P. H. Bates, etc.) on synthesis of calcium silicates and aluminates of principal hydraulic constituents of portland cement, aluminous cement, etc., the mixtures of silica or alumina and lime or calcium carbonate were directly sintered or fused without any attention to their intermediate reactions. But, in the authors' preliminary studies, calcium aluminates, $CaO . Al_2O_3$ and $5Ca . O3Al_2O_3$, are easily formed by heating to far below temperatures of their melting temperatures 1450 deg. C. (by Bates, Dyckerhoff, etc.) and 1500 deg. C. (by Schott) or 1600 deg. C. (by Bates, Dyckerhoff, etc.) etc.

In the present paper, the authors reported the results of studies on the formation of two sorts of calcium aluminates, $CaO . Al_2O_3$ and $5CaO . 3Al_2O_3$, by heating the mixture of Al_2O_3 and $CaCO_3$ mixed in the proportion of 1 : 1 or 5 : 3. By the determination of free lime in the heated mass by the Lerch and Bogues' method (W. M. Lerch and R. H. Bogue, "Journ. Ind. Eng. Chem.," 1926, *18,* 740) or by the Rathke's method (H. Rathke, "Tonind. Ztg.," 1928, *52,* 1318), and free alumina in the form of insoluble residue, the combined lime and alumina were obtained by subtracting these free lime and alumina from the total lime and alumina determined in the original mixtures. The molar ratios of lime to alumina were obtained from these results of combined lime and alumina, and their values were compared to the molar ratio 1.00 of $CaO . Al_2O_3$ or 1.67 of $5CaO . 3Al_2O_3$. The specific gravities of the heated powder were also determined and compared to those of the original mixtures.

By these strictly quantitative methods, the formation of these two aluminates by heating to various temperatures under 1300 C., i. e., 950, 1050, 1100, 1150, 1200, 1250, 1300 deg. C., etc., were tabulated as in the following Tables 1 and 2.

TABLE 1.

Formation of $CaO . Al_2O_3$ by Heating Under 1300 *Deg. C.*

No.	Temperature in °C.	Time in min.	Free CaO %	Free Al_2O_3 (Insol. res.) %	Comb. CaO %	Comb. Al_2O_3 %	Molar Ratio CaO/ Al_2O_3 %	Specific Gravity
A_{102}	950°	120	33.0	54.1	2.6	10.2	0.47	----
A_{103}	1050°	60	32.0	52.7	3.3	11.6	0.52	3.30
A_{104}	"	"	31.7	53.5	3.6	11.3	0.56	3.28
A_{105}	1100°	"	26.3	50.2	9.1	14.2	1.17	----
A_{106}	1150°	"	25.3	49.7	9.7	15.3	1.16	3.29
A_{107}	"	"	25.0	49.5	10.0	15.5	1.18	3.27
A_{108}	"	240	13.2	26.4	24.0	39.2	1.12	2.97
A_{109}	1200°	60	17.8	37.4	18.0	26.9	1.21	3.20
A_{110}	1250°	"	9.1	22.9	26.0	42.0	1.13	2.99
A_{116}	"	150	2.7	9.4	32.4	55.5	1.06	2.91
A_{118}	"	240	3.4	12.5	31.6	53.4	1.07	2.91
A_{119}	"	420	2.4	7.8	32.7	57.1	1.04	2.85

In this table, the molar ratios of A_{102}, A_{103} and A_{104} are too small, owing to the incorrect values of free lime determination in the presence of alumina heated under 1050 deg. C. On the contrary, the molar ratios of A_{105}, A_{106}, A_{107}, A_{109} and A_{110} are too high, showing the formation of some parts of $5CaO . 3Al_2O_3$. This fact is also clearly seen in the next Table 2. The samples of A_{116}, and A_{119} are composed of nearly 90 per cent of $CaO . Al_2O_3$, being determined by the total sum of combined lime and alumina, their values of molar ratios 1.04 or 1.06 which is nearly equal to the theoretical value 1.00, and the specific gravity 2.85 or 2.91 (2.91 by Bates, 2.98 by Dyckerhoff obtained from fused products).

TABLE 2.

Formation of $5CaO . 3Al_2O_3$ by Heating Under 1300 *Deg. C.*

No.	Temperature in °C.	Time in min.	Free CaO %	Free Al_2O_3 (Insol. res.) %	Comb. CaO %	Comb. Al_2O_3 %	Molar Ratio CaO/ Al_2O_3 %	Specific Gravity
A_{502}	950°	120	45.2	43.2	2.6	9.0	0.52	3.27
A_{503}	1050°	60	39.7	38.1	8.1	14.1	1.05	3.22
A_{505}	1150°	"	36.6	35.5	10.9	17.1	1.16	3.23
A_{506}	1200°	"	31.6	27.7	15.9	24.9	1.16	3.16
A_{507}	1250°	"	27.0	20.8	20.5	31.8	1.18	3.12
A_{508}	"	240	16.0	9.0	31.8	42.6	1.36	3.01
A_{509}	"	"	15.9	9.1	31.9	43.1	1.35	2.97
A_{510}	"	900	1.4	1.1	46.0	51.6	1.64	2.79

In the table, the molar ratio of A_{502} 0.52 is also smaller than 1.00 of $CaO . Al_2O_3$ or 1.67 of $5CaO . 3Al_2O_3$, but the values of molar ratios of A_{505}, A_{506} and A_{507} are nearly equal to those of A_{105}, A_{106}, A_{107}, A_{109} and A_{110} in the Table 1, this fact showing the formation of some parts of $CaO . Al_2O_3$ mixed with $5CaO . 3Al_2O_3$. The values of these molar ratios became greater in A_{508} and A_{509} to 1.35 or 1.36 and at last to 1.64 in A_{510}, which is nearly equal to the theoretical value 1.67 of $5CaO . 3Al_2O_3$. This shows clearly the fact that by heating the mixture of Al_2O_3 and $CaCO_3$ in the proportion of 1 : 1 or 5 : 3, some parts of $CaO . Al_2O_3$ is first formed and then $5CaO . 3Al_2O_3$ predominates slowly to $CaO . Al_2O_3$ in the long heating at 1250 deg. C. The transformation of $CaO . Al_2O_3$ as formed in A_{116} or A_{119} to $5CaO . 3Al_2O_3$ by heating the sample as A_{116} or A_{119} again to 1300-1350 deg. C. is now strictly being examined, which will be reported, with the further studies on $3CaO . Al_2O_3$, $5CaO . 3Al_2O_3$, $CaO . Al_2O_3$, and $3CaO . 5Al_2O_3$ in the higher fusing or melting temperatures, in their next papers.

Czechoslovakian Kiln Equipment

In the description of Czechoslovakia's largest cement plant—that at Kraluv Dvur—in the July issue of CONCRETE, mention should have been included of the rotary kilns, of which there are three. They are 150 ft. by 10 and 15 ft. 5 in. in diameter, of Fellner & Ziegler manufacture. The output is 1800 bbls. each with a total coal consumption of 73 lbs. per bbl. of 13,000 B. t. u.

Three Wittcovitz waste heat boilers of 10,600 sq. ft. each and one Bruenn waste heat boiler of 14,000 sq. ft. are attached to the kilns. Four boilers furnish steam for 4200 kw. The dust in the kiln gases is precipitated in a Siemens-Schuckert electrical dust collecting system. Fuller-Kinyon equipment is employed throughout for conveying pulverized materials.

Cement Safety Meeting Held in Utah

A Utah regional safety meeting was held at Ogden on Saturday, September 29th, attended by 50 representatives from Brigham City, Devils Slide, Salt Lake City, and Pocatello, Idaho. O. F. McShane of the Utah industrial commission, as one of the speakers, said that cement companies lead all other industries in the state in the prevention of accidents.

The meeting closed with a banquet, at which Ralph E. Bristol was toastmaster. At this time Gerald Yearsley, safety inspector for the Utah industrial commission, was the principal speaker.

Cement Statistics for September

Production and Shipments Both for Month and Year to Date Lower Than for 1928—Number of Plants Reporting Increases to 166

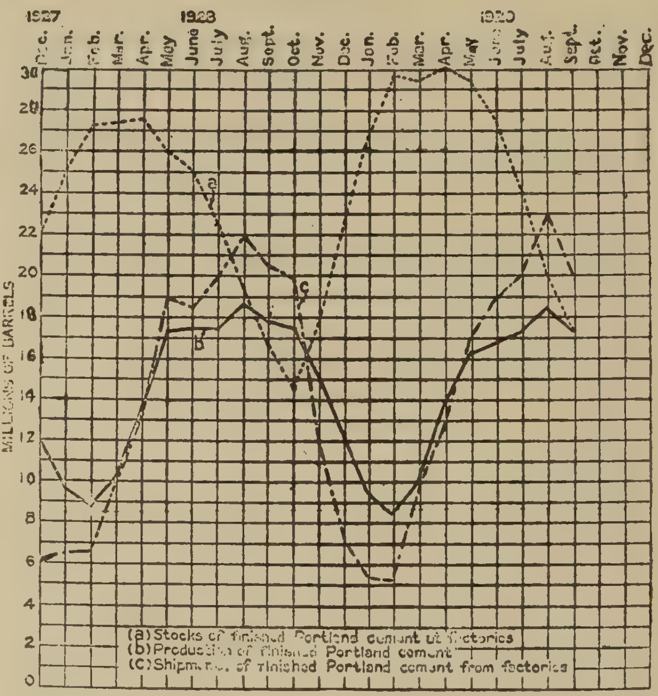
NOTE: IN ORDER THAT THE READER MAY KNOW THE TREND AT A GLANCE, THE HIGHER FIGURE, WHETHER FOR EITHER YEAR, UNDER ANY CLASSIFICATION, APPEARS IN SLIGHTLY HEAVIER TYPE.

Relation of Production to Capacity

(Figures represent per cent)

	—September— 1928	1929	August 1929	July 1929	June 1929
The month	**91.7**	81.8	86.1	80.4	80.9
The 12 months ended	**73.7**	67.5	68.2	68.9	69.0

	1928	1929	Increase or Decrease, Per Cent
Production, September	**17,884,000**	17,223,000	—3.7
Shipments, July	**20,460,000**	19,950,000	—2.5
Stocks at end of Sept.	16,799,000	**17,329,000**	3.2
Total production for year to date	**131,178,000**	128,183,000	—2.3
Total shipments for year to date	**136,284,000**	133,545,000	—2.0
No. of plants reporting	159	**166**	



Production, Shipments and Stocks of Finished Portland Cement, by Districts, in September, 1928 and 1929, and Stocks in August, 1929

District	Production—September 1928	1929	Shipments—September 1928	1929	Stocks at end of month 1928	1929	Stocks at end of August 1929*
Eastern Pa., N. J., and Md.	**3,610,000**	3,600,000	**4,141,000**	3,925,000	**4,987,000**	4,452,000	4,777,000
New York and Maine	1,205,000	**1,241,000**	1,355,000	**1,434,000**	1,273,000	**1,274,000**	1,467,000
Ohio, Western Pa., and W. Va.	**2,276,000**	1,919,000	**2,559,000**	2,386,000	2,159,000	**2,685,000**	3,152,000
Michigan	**1,573,000**	1,519,000	**1,991,000**	1,800,000	879,000	**957,000**	1,238,000
Wis., Ill., Ind., and Ky.	**2,411,000**	2,182,000	**3,085,000**	2,759,000	1,283,000	**1,740,000**	2,318,000
Va., Tenn., Ala., Ga., Fla., and La.	**1,433,000**	1,298,000	**1,475,000**	1,311,000	**1,634,000**	1,610,000	1,623,000
Eastern Mo., Ia., Minn., and S. Dak.	**1,735,000**	1,670,000	2,236,000	**2,325,000**	**1,572,000**	1,426,000	2,081,000
W. Mo., Neb., Kans., Okla., and Ark.†	1,201,000	**1,422,000**	1,270,000	**1,542,000**	**1,164,000**	805,000	926,000
Texas	544,000	**707,000**	520,000	**680,000**	281,000	**493,000**	466,000
Colo., Mont., Utah, Wyo.,† and Idaho†	**321,000**	314,000	316,000	**358,000**	387,000	**475,000**	518,000
California	**1,124,000**	967,000	**1,102,000**	1,023,000	768,000	**941,000**	997,000
Oregon and Washington	**451,000**	384,000	**410,000**	407,000	412,000	**471,000**	493,000
	17,884,000	17,223,000	**20,460,000**	19,950,000	16,799,000	**17,329,000**	20,056,000

Production, Shipments, and Stocks of Finished Portland Cement, by Months, in 1928 and 1929

Month	1928—Production	—1929	1928—Shipments	—1929	Stocks at end of month 1928	1929
January	9,768,000	**9,881,000**	**6,541,000**	5,707,000	25,116,000	**26,797,000**
February	**8,797,000**	8,522,000	**6,563,000**	5,448,000	27,349,000	**29,870,000**
March	**10,223,000**	9,969,000	**10,135,000**	10,113,000	27,445,000	**29,724,000**
April	13,468,000	**13,750,000**	13,307,000	**13,325,000**	27,627,000	**30,151,000**
May	**17,308,000**	16,151,000	**18,986,000**	16,706,000	25,984,000	**29,624,000**
June	**17,497,000**	16,803,000	18,421,000	**18,949,000**	25,029,000	**27,457,000**
July	**17,474,000**	17,281,000	19,901,000	**20,295,000**	22,580,000	**24,525,000**
August	**18,759,000**	*18,585,000	21,970,000	***23,052,000**	19,374,000	***20,056,000**
September	**17,884,000**	17,223,000	**20,460,000**	19,950,000	16,799,000	**17,329,000**
October	17,533,000	....	19,836,000	....	14,579,000	....
November	15,068,000	....	11,951,000	....	17,769,000	....
December	12,189,000	....	7,384,000	....	22,650,000	....
	175,968,000	....	175,455,000	....	....	....

*Revised.

†The inclusion of Wyoming begins with April, 1929; of Idaho with June, 1929; of Arkansas with September, 1929.

MEN and MILLS

Notes from the Field

Alfred Smith New Vice-President of Four Monoliths

Alfred F. Smith has been elected vice-president of each of the four Monolith companies, all of which are under the same management and control. They are the Monolith Portland Cement Company, Monolith Portland Midwest Company, Monolith Portland Gulf Company, and the Monolith Corporation.

Prior to becoming an official of the four concerns named, Mr. Smith was chairman of the executive committee of the Monolith Portland Cement Company of California, having been elected to that position last April following his purchase of a substantial interest in the companies.

The new Monolith executive, while at Portland, Oregon, was head of the Columbia River Shipbuilding Corporation and the Smith & Watson Iron Works, and also was heavily interested in the logging and paper mill machinery manufacturing business.

Dewey Entertains Purchasing Agents at Plant

Herbert E. Tyler, vice-president of the Dewey Portland Cement Company, Davenport, Iowa, was host to a number of members of the Tri-City Association of Purchasing Agents on September 16th.

The delegates, who are members of an organization composed of buyers and purchasing agents and other officials of business and industrial concerns in the vicinity of Davenport, were shown through the plant and later entertained at a banquet. Talks were given by Mr. Tyler and by Leo Capen, sales manager of the Dewey company.

Richard in Charge of Public Relations for Stockton Plant

S. J. Richard has been appointed head of the Port Stockton Cement Company public relations department and will be in charge of the company offices at Stockton, Calif.

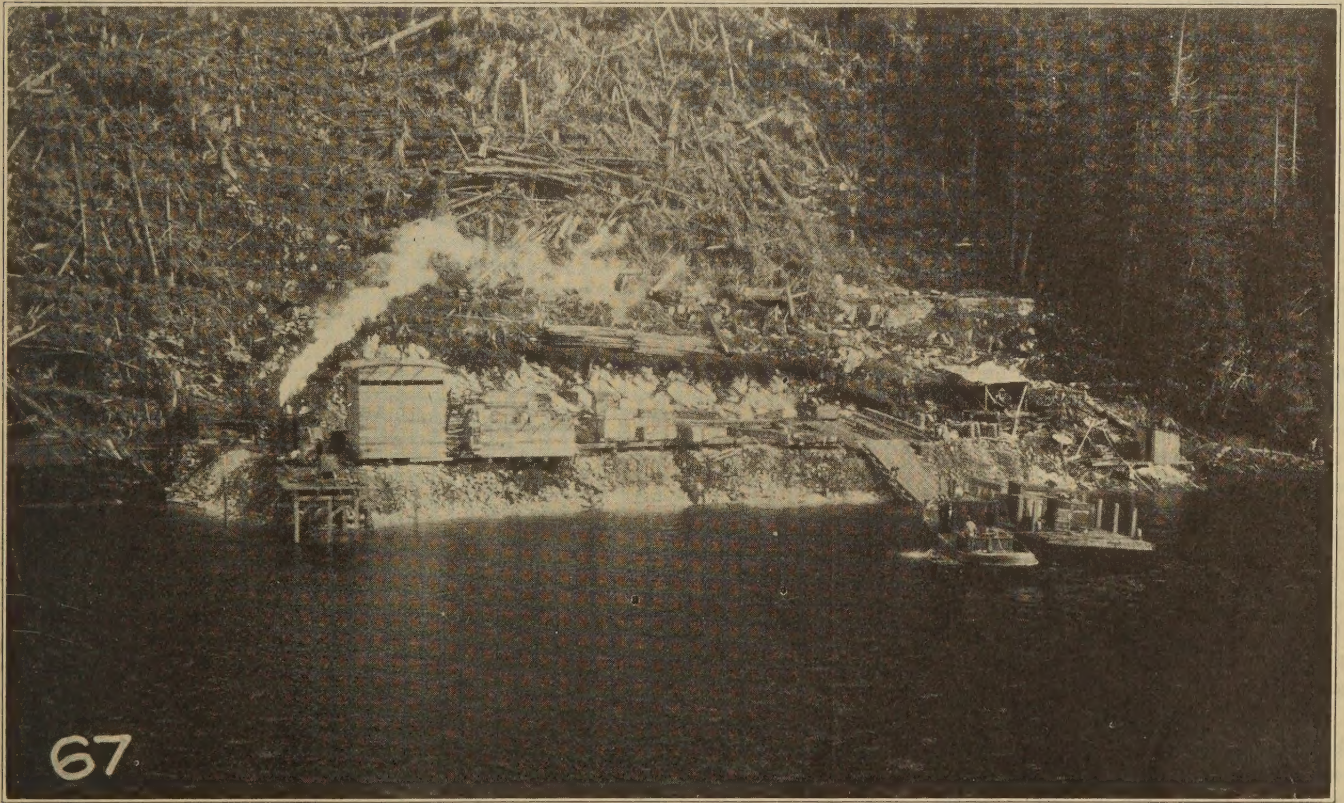
Mr. Richard will work in co-operation with the Stockton citizens' committee. He is the former secretary-manager of the local chamber of commerce.

Monolith Sponsors Home Design Competition

The Monolith Portland Cement Company of California, is joint sponsor with the American Institute of Architects of a small homes competition at Denver, Colo., for architects, architectural draftsmen, students, etc., and has selected three Denver architects as judges.

Attends U. S. Chamber of Commerce Meetings

J. E. Zahn, secretary of the United States Portland Cement Company of Denver, Colorado, was one of the local Chamber of Commerce committeemen to attend the seventh annual regional meetings of the United States Chamber of Commerce, in Ogden, Utah, September 30-October 1.



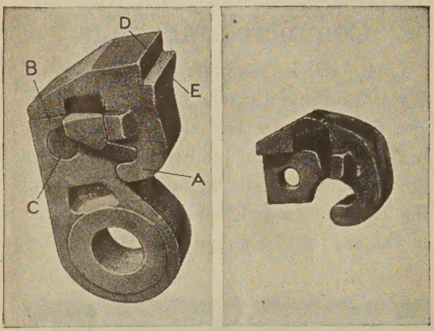
In far-off Alaska whence comes the limestone used at the plant of the Pacific Coast Cement Co. at Seattle.

Mill Equipment

New Renewable-Tip Crusher Hammer

A new renewable tip hammer has been developed, in sizes to suit any of the standard hammer mills used in cement mills, by W. C. Briggs, Bankers Trust Building, Philadelphia, Pa.

The tendency of the tips to work loose under the influence of centrifugal force and the hammer impacts is claimed to be overcome in the patented Briggs design. The masses are so disposed that both centrifugal force and the hammer impacts tend to lock the parts together. No looseness is produced by impact, and whatever slight amount may occur from abrasion of the bearing surfaces is immediately taken up by centrifugal force. As there is no slack, the mass of the arm and the mass of the tip operate as in a solid hammer. How this is done is made plain by the photographs.



The hammer arm and tip have a hook-shaped interlock *A*. When assembling, the hook is first engaged, and the tip then swung back as on a hinge, till bearing surfaces *B* are in contact. Rivet *C* is then inserted and headed. The center of gravity of the tip is forward of the hook. Hence the effect of centrifugal force is to hold the bearing faces *B* firmly in contact. It is not even necessary that rivet *C* be tight, so long as it cannot come out, though naturally a reasonable effort is made to have it fill the hole.

Discarding the reversible design (which is made possible by the low cost of the tip) has led to some interesting results. The tip is designed solely for maximum performance on one face: hence it can be given back and side clearances.

Long life for the tip is secured by having two cutting edges. At first only the outer edge *D* operates. The second, *E*, comes into action when the outer edge has been worn away and the arms are set out.

Features of New Gardner-Denver Rock Drill

The Gardner-Denver Co., Denver, Colo., is now producing a new model 11 rock drill. This is a light, all-purpose drill that can be used for wet or dry drilling. It weighs 50 pounds and has a drilling speed equal to that of heavier machines, the manufacturer says, and gives an unusually heavy daily footage with a minimum of strain upon the operator. It is rotated by a rifle bar and ratchet.

This new drill may be mounted for light drifting, channelling with a quarry bar, used on a tripod, or for miscellaneous work where a light mounted drill is desired. It takes steel ranging from ⅞ to one inch.

While in ordinary operation this drill is said to keep the hole clean and free from cuttings by means of sending a strong air current through the drill steel. When drilling unusually deep holes, a special blowing device can be turned on. A single oil reservoir in the cylinder lubricates all moving parts or Gardner-Denver air line oilers also can be used on it.

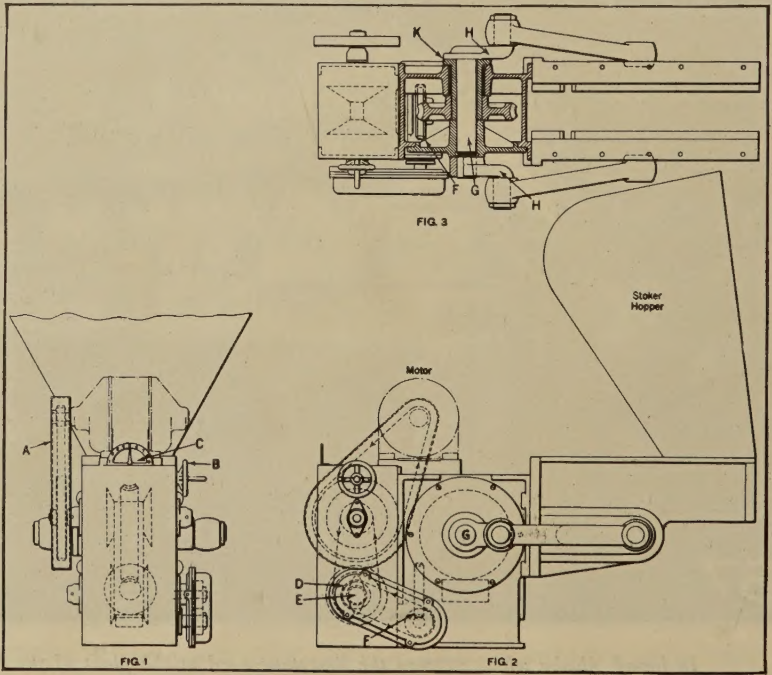
Electric Motor Drive for Type E and Type K Stokers

The Type E and Type K Underfeed Stokers, manufactured by Combustion Engineering Corporation, New York, are usually steam driven. An electric motor drive has recently been developed which is applicable to either of these stokers and may be used wherever the steam drive is impractical, as for instance, where the operating steam pressure is below 60 pounds per square inch.

The electric drive is described by the manufacturer as follows: The drive consists of a double worm gear reduction unit and a Reeves variable speed transmission unit. The gear case assembly is compact. All parts are fully encased, yet readily accessible. The motor is located on the flat, top surface of the gear case which provides a convenient and solid support. Furthermore, in this position the motor is well removed from the usual floor dirt of the boiler room and is out of the way when the floors are washed. Access to the fire doors is not hindered in any way.

The Reeves mechanism is driven by a silent chain from the motor as shown by A in Fig. 1. On the opposite side at B, is the hand-wheel, conveniently located, for adjusting the speed changes. The ratio of speed change is from 1 to 8, which is ample for the usual range of combustion rates.

Fig. 2 shows the side view arrangement. A silent chain drive, D, connects the lower shaft, E, of the Reeves mechanism with the first worm gear reduction, F, from which power is transmitted through the double set of worm gears to the crank shaft, G. Fig. 3 is a plan view. On each end of crankshaft G are cranks H, from which twin connecting rods transmit power to the under side of the pusher block of the stoker.



A NEW DESIGN

BOX-HEADER BOILER

The new C-E Single-Seam Box-Header Boiler is a distinct advance in construction and design over ordinary box header practice.

In the new design —

The wrapper or butt strap joining the tube and hand hole sheets is — ELIMINATED.

ONE ROW OF RIVETS JOINS THE TUBE SHEET DIRECTLY TO THE HAND HOLE SHEET.

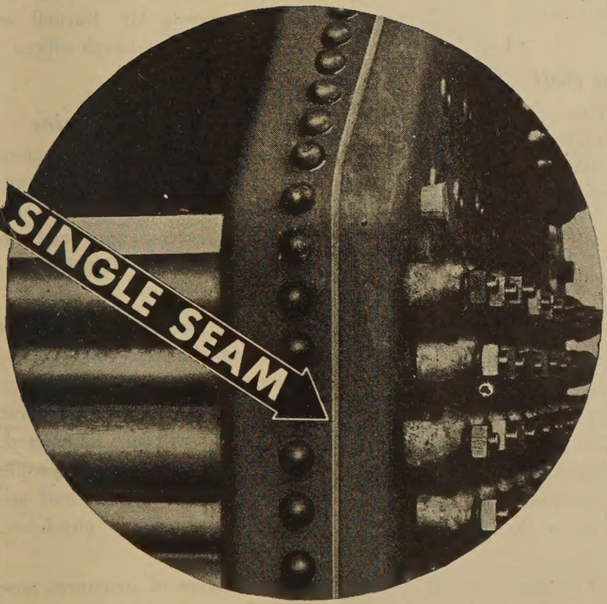
The row of rivets on the tube side of the wrapper strap is — ELIMINATED.

THERE IS ONLY ONE CAULKING EDGE and this faces the outside — making inspection easy and removing all rivets out of the hot gas and fire zones.

Three thicknesses of metal at the caulking joint at the ears are — REDUCED TO TWO THICKNESSES.

This new design provides an unusual factor of safety. For instance, in the standard unit sold for 160 lb. to 250 lb. working pressure, the header joint is adequate for a working pressure of 450 lb.

A careful inspection of this new boiler will convince you that the C-E Box-Header Boiler is a better Box-Header Boiler.



COMBUSTION ENGINEERING CORPORATION
International Combustion Building
200 Madison Avenue, New York
A Subsidiary of
International Combustion Engineering Corporation

With the Manufacturers

INDUSTRIAL LITERATURE

Metallic Surfacing

Type-T metal is a new alloy furnished in the form of welding rod for applying a high wear resistant surface by either the oxy-acetylene or metallic arc welding processes. It is described in Bulletin No. 3 issued by the *Fusion Welding Corporation*, Chicago.

Unusual ductility, wearability and hardness are the features stressed.

Industrial Safety

"*Workmen's Safety Committees,*" report number 5 in the *Industrial Safety Series* published by the Policyholders Service Bureau of the *Metropolitan Life Insurance Company*, has just been issued by the bureau. The leaflets in the series are based upon studies of successful accident prevention work undertaken by modern industrial establishments.

In this and subsequent publications in the survey, attention will be given to methods used to reach the workmen, encouraging their interest in safety. The workman's safety committee, dealt with in this report, has proven an excellent medium through which responsibility for aiding in the prevention of accidents can be delegated to certain selected employees.

Plant safety engineers and other interested executives may secure copies of this study by writing the Policyholders Service Bureau, Metropolitan Life Insurance Company, New York City.

Use of Explosives

"*Commercial Explosives: Their Safe and Proper Use*" is the name of a new booklet just issued by the *Hercules Powder Company*, Wilmington, Del. This booklet is intended to aid users of explosives in improving blasting practices and avoiding accidents.

The new booklet defines explosives, lists the various types and their characteristics, and offers directions for loading, priming, and firing. Modern types and processes are enumerated.

Handling and storage of explosives is also covered and general safety rules cited, many of which are recommendations of the National Safety Council, the United States Bureau of Mines, and the Institute of Makers of Explosives. In addition the Hercules booklet offers information on detonators, blasting machines, and other blasting accessories.

Catalog on Copes Devices

A complete description of *Copes* feed water regulators for both low and high pressure service, with numerous photographs of actual installations, is one of the features of a newly completed catalog issued by the *Northern Equipment Company*, Erie, Pa.

According to the latter, the Copes Type RG combined feed-flow-water-pressure regulator is for the first time included in a catalog, as are also the Type SS differential water pressure regulating valve, the Copes Type DS pump governor, the Copes control valves, condensate drainage control and the Copes valve movement indicator.

Squirrel Cage Motor Publication

Seven types of squirrel cage motors are discussed and compared with each other in the new 24-page bulletin, *No.* 165, issued by *Wagner Electric Corporation*, St. Louis, Mo., under the headings of general purpose, normal-torque across-the-line, low-torque across-the-line, high-torque double-squirrel cage, punch press and elevator types. The bulletin is divided into several sections, one discussing the three factors interesting motor buyers (cost, performance and delivery), another analyzes and compares the starting and running characteristics of the various types of squirrel cage motors, and there are other sections devoted to detailed description of construction, ventilation, lubrication and mechanical diversifications.

NOTES FROM THE FIELD

Westinghouse Stocks Director

Announcement has been made of the appointment of *H. C. Thomas* as director of manufacturing stocks of the *Westinghouse Electric and Manufacturing Company*. In his new work he will be responsible for the methods used in the control of all raw materials, work in progress and finished part stocks.

Mr. Thomas is being advanced from the position of assistant general manager of the merchandising department with offices in Mansfield, Ohio. In his new work his offices will be in East Pittsburgh.

Greene to Chain Belt

Hibbard S. Greene, former vice-president and director of the Barber-Greene Company, of Aurora, Illinois, has been appointed assistant to the president of the *Chain Belt Company.*

Mr. Greene will co-ordinate the marketing plans of the *Chain Belt Company, Sivyer Steel Casting Company, Federal Malleable Company* and the *Interstate Drop Forge Company*, all of Milwaukee, Wisconsin, as well as the *Stearns Conveyor Company* of Cleveland, Ohio, the latter company being a division of the Chain Belt Company. The same financial interests control the above four companies. A wide range of products will be covered in the plan.

Before the Barber-Greene Company was established, Mr. Greene was connected with the National Carbon Company in Cleveland, Ohio.

Link-Belt Personnel

W. C. Carter, formerly vice-president in general charge of production at all Link-Belt plants, has assumed the duties of vice-president and general manager of the Chicago plant of the *Link-Belt Co.* He succeeds *F. B. Caldwell*, resigned on account of health.

E. J. Burnell, who was manager of the Pittsburgh office, has been appointed sales manager of the western division, with headquarters at the Chicago plant.

Nels Davis, from the Chicago engineering sales force, succeeds Mr. Burnell as manager of Link-Belt's Pittsburgh office.

New Hercules Laboratories

Plans for the erection near Wilmington, Del., of a new experimental station consisting of experimental and chemical research laboratories were announced in September by the *Hercules Powder Co.*, Wilmington.

Construction will consist of a main building, containing chemical laboratories, offices and library, and auxiliary buildings housing experimental plants. A power house and store rooms will also be erected. At the present station about 120 people are employed of whom more than half are technically trained chemists, physicists, and engineers.

Following the erection of structures now being designed the experimental staff and research equipment will be moved here from Kenvil, New Jersey, the present site.